SOIL SURVEY OF
MEDINA COUNTY, TEXAS

ELECTRONIC VERSION

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United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1961-71. Soil names and descriptions were approved in 1972. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Bandera Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

This soil survey contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Medina County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification and pasture and hayland group of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the range sites, and the pasture and hayland groups.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the sections "Engineering Uses of the Soils" and "Use of the Soils for Recreation."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Medina County may be interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Additional Facts About the County."

Cover: Typical area of Bracket-Rock outcrop association, hilly, characterized by rounded hills and a benched or stairstep appearance.

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SOIL SURVEY OF
MEDINA COUNTY, TEXAS

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**United States Department of Agriculture, Soil Conservation Service,
In Cooperation With The Texas Agricultural Experiment Station**

MEDINA COUNTY has an area of about 1,357 square miles, or 868,480 acres, and is in the southwestern part of Texas (fig. 1).

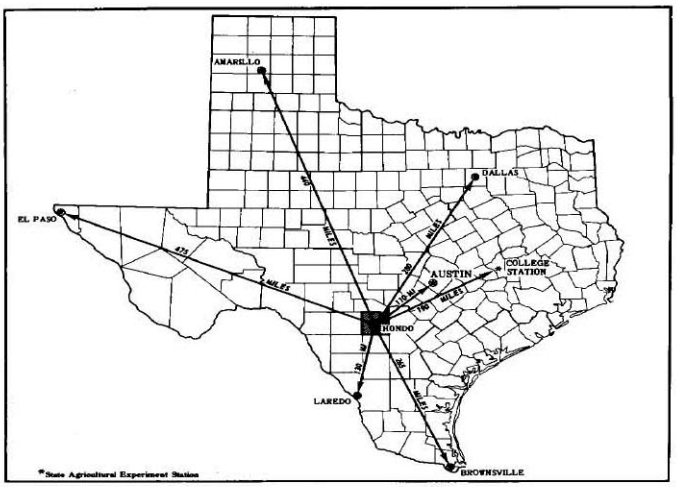

***Figure 1.*—Location of Medina County in Texas.**

Hondo is the county seat. It is in the center of the county, about 40 miles west of San Antonio on U.S. Highway 90. Other major towns are Devine and Natalia in the southeastern part of the county; Rio Medina, Castroville, and LaCoste in the eastern part; D'Hanis in the western part; and Yancey in the southern part.

U.S. Highway 90 crosses the county from east to west through Castroville, Hondo, and D'Hanis; U.S. Highway 81 and Interstate Highway 35 cross the southeastern part of the county through Natalia and Devine. State Highway 173 connects Hondo with Devine. Many farm roads and ranch roads also cross the county.

The Southern Pacific Railroad crosses the county from east to west through LaCoste, Hondo, and D'Hanis. The Missouri Pacific Railroad parallels U.S. Highway 81 and Interstate Highway 35 through Natalia and Devine.

The major streams of the county are the Medina River, Chacon Creek, Hondo Creek, San Francisco Perez Creek, San Geronimo Creek, Seco Creek, and Verde Creek. The Frio River flows just inside the southwestern part of the county for a short distance. All of these streams flow in a south to southeast direction.

Medina Lake, on the Medina River in the extreme north-eastern part of the county, provides water for irrigation and for recreation. Medina Lake covers 5,575 acres at spillway level. It is about 18 miles long when full and has a shoreline of 110 miles. The center of the lake serves as the boundary between Medina and Bandera Counties.

Oil and gas exploration is in progress, mostly in the southeastern part of the county. A number of small wells have been drilled.

Farming and ranching are the major enterprises in the county. About 633,000 acres are used for raising beef cattle, sheep, and goats. About 213,500 acres are used for crops and pasture, of which about 32,000 acres are irrigated. The main dryfarmed crops are grain sorghums, small grains, corn, cotton, peanuts, and improved pasture grasses. Under irrigation, these crops and vegetable and truck crops are grown. Much of the irrigation water is from deep wells that reach into the Edwards Limestone formation or the Carrizo Sands formation, but a large area is irrigated with water from Medina Lake.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Medina County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Castroville and Quihi, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Castroville clay loam, 0 to 1 percent slopes, is one of two phases within the Castroville series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photo-graphs show buildings, field borders, trees, and other de-tails that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Medina County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern

and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils. Orif complex is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Kavett-Tarrant association, undulating, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Yologo and Hindes soils, 1 to 8 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock outcrop is a land type in Medina County.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Medina County. A soil association is a landscape that has a distinctive proportional pattern of soils. It generally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed or a wildlife area, or in planning engineering works, recreation facilities, and community developments. It is

not a suitable map for planning the management of a farm or field or for selecting the exact location of a road or building or other structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Medina County are discussed in the following pages. The terms for texture used in the titles of the associations apply to the texture of the surface layer of the major soils. For example, in the title of association 1, the words "loamy and clayey" refer to the texture of the surface layer.

1. Knippa-Mercedes-Castroville association

Deep, nearly level to gently sloping, loamy and clayey, calcareous soils

This soil association is on broad, smooth uplands and covers about 30 percent of the county. It is about 23 percent Knippa soils, 19 percent Mercedes soils, and 17 percent Castroville soils. Minor soils making up the remaining 41 percent of the association include Atco, Austin, Caid, Divot, Monteola, Olmos, Orif, Quihi, Sabenyo, Valco, and Victoria soils.

The Knippa soils have a surface layer of brown and dark-brown clay about 14 inches thick. The next layer is reddish-brown clay in the upper 12 inches and brown clay in the lower 8 inches. The layer below that is light-brown clay loam that contains many calcium carbonate lumps and concretions.

The Mercedes soils have a surface layer of gray clay about 54 inches thick. The layer below that is light brownish-gray clay.

In the Castroville soils, the surface layer is clay loam. It is grayish brown in the upper 6 inches and dark grayish brown in the lower 10 inches. The next layer extends to a depth of about 35 inches. The upper part is brown clay loam, and the lower part is brown clay. Below that layer is light-brown clay that contains many calcium carbonate masses.

For the most part, Mercedes and Castroville soils are in the low places, and Knippa soils are in slightly higher places.

About 66 percent of this association is cultivated, and 34 percent is used for range and wildlife habitat. About 15 percent of the cultivated acreage is irrigated. The major soils are well suited to irrigation and too many kinds of crops. If properly managed, they can produce an abundance of grasses, forbs, and shrubs. Deer, turkey, quail, dove, and other wildlife are plentiful, especially along streams. Farm ponds scattered over the area provide fishing and other forms of recreation.

2. Tarrant-Real-Brackett association

Very shallow and shallow, gently sloping and undulating to steep, loamy, gravelly loamy, and cobbly clayey, calcareous soils

This soil association is on the more sloping, dissected areas of the county and covers about 19 percent of the county. It is about 38 percent Tarrant soils, 18 percent Real soils, and 12 percent Brackett soils. Minor soils making up the remaining 32 percent of the association include Austin, Dina, Doss, Kavett, Mereta, Orif, Pratley, Speck, and Topia soils. Rock outcrop is common in areas of these soils.

The Tarrant soils are very shallow or shallow. These soils have a surface layer of very dark grayish-brown and dark-brown cobbly clay about 16 inches thick that is underlain by fractured limestone bedrock. They are moderately slowly permeable. Coarse fragments cover 35 to 90 percent of the surface. The Tarrant soils have convex to plane, undulating to steep slopes and are on ridgetops and breaks.

The Real soils are very shallow or shallow. The upper part of the surface layer is very dark grayish-brown, calcareous gravelly clay loam about 4 inches thick.

The lower part is dark grayish-brown very gravelly clay about 9 inches thick. It is underlain by weakly cemented limestone. These soils are moderately slowly permeable and are gently sloping to sloping and undulating.

The Brackett soils are shallow. These soils have a surface layer of light brownish-gray loam about 5 inches thick. The layer below that is pale-yellow loam about 9 inches thick; it overlies interbedded limestone and marl. Stones, pebbles, and cobblestones are on the surface. Outcropping slabs of limestone give the landscape a “stairstep" appearance. These soils are moderately slowly permeable and are undulating to steep.

The soils of this association are used for range and wildlife habitat. Most of the major soils are not suitable for cultivation, but a few small isolated areas are cultivated and cropped where some of the deeper minor soils of the association occur. A variety of grasses, forbs, and shrubs provides palatable food for cattle, sheep, and goats and for wildlife, especially white-tailed deer. The association is well stocked with deer. Overgrazed areas erode easily.

3. Olmos-Yologo-Hindes association

Very shallow to moderately deep, gently sloping to sloping and undulating, gravelly and loamy, noncalcareous to calcareous soils

This soil association is on gravelly upland ridges and covers about 15 percent of the county. It is about 30 percent Olmos soils, 20 percent Yologo soils, and 6 percent Hindes soils. Minor soils making up the remaining 44 percent of the association include Castroville, Caid, Duval, Devine, Kincheloe, Knippa, Lacoste, Mercedes, Monteola, Quihi, Rehm, Valco, and Webb soils.

The Olmos soils are very shallow or shallow. The upper part of the surface layer is dark grayish-brown, calcareous gravelly clay loam about 5 inches thick. The lower part is dark grayish-brown clay loam about 9 inches thick that overlies hardened caliche. These soils are moderately permeable. They are mainly on the lower part of gravelly ridges.

The Yologo soils are very, shallow or shallow. These soils have a surface layer of reddish-brown, noncalcareous gravelly loam about 4 inches thick. Below this is brown very gravelly clay, 7 inches thick, that is underlain by indurated caliche plates. These soils are moderately permeable. They are on low ridges and knolls.

The Hindes soils are moderately deep. They have a surface layer of noncalcareous, dark reddish-brown gravelly sandy clay loam about 4 inches thick. The layer below that is dark reddish-brown very gravelly clay 26 inches thick. It is underlain by caliche. These soils are moderately slowly permeable. They are on side slopes, ridges, and knolls.

Most of this association is used for range and wildlife habitat. It is grazed mainly by cattle. In general, the association is not suitable for cultivation. The vegetation consists of grasses, forbs, and thorny brush. Wildlife is generally plentiful; deer do well on the shrubs and forbs that grow. Overgrazed areas erode easily. In some areas caliche is mined for road material.

4. Duval-Miguel-Amphion association

Deep, nearly level to gently sloping, loamy, noncalcareous soils

This soil association is on smooth, broad, uplands and covers about 14 percent of the county. It is about 28 percent Duval soils, 14 percent Miguel soils, and 14 percent Amphion soils. Minor soils making up the remaining 44 percent of the association include Caid, Divot, Hams, Lacoste, Nueces, Olmos, Poth, Tiocano, Webb, Wilco, and Yologo soils.

The Duval soils have a surface layer of brown fine sandy loam about 10 inches thick. The layer below that is sandy clay loam. It is reddish brown in the upper 7

inches and red in the lower part. These soils are moderately permeable. They are on uplands.

The Miguel soils have a surface layer of brown fine sandy loam about 10 inches thick. The layer below that is yellowish-brown and brown clay in the upper 25 inches and is reddish-yellow sandy clay loam in the lower part. These soils are very slowly permeable. They are on stream terraces and upland plains.

The Amphion soils have a surface layer of clay loam about 10 inches thick. The upper part is very dark grayish brown, and the lower part is very dark gray. The layer below that is clay that extends to a depth of 39 inches. The upper part is very dark gray and dark grayish brown, and the lower part is brown. Below that is very pale brown clay loam. These soils are moderately slowly permeable. They are on upland plains.

About 75 percent of this association is used for range and wildlife habitat, and 25 percent is cultivated. About 25 percent of the cultivated acreage is irrigated. The control of erosion is a problem on bare slopes. This association supports less wildlife than other associations.

5. Speck-Pratley-Mereta association

Moderately deep and shallow, nearly level to gently sloping and undulating, loamy and clayey, noncalcareous to calcareous soils

This soil association is mostly on side slopes and in depressions along drainage ways in the uplands. It covers about 10 percent of the county. It is about 47 percent Speck soils, 17 percent Pratley soils, and 13 percent Mereta soils. Minor soils making up the remaining 23 percent of the association include Brackett, Castroville, Dina, Divot, Kavette, Knippa, Orif, Real, Tarrant, and Topia soils.

The Speck soils are shallow. These soils have a surface layer of dark-brown, noncalcareous clay loam about 7 inches thick. The layer below that is dark reddish-brown clay 8 inches thick; it overlies limestone bedrock. These soils are slowly permeable. They are on low ridges and side slopes.

The Pratley soils are moderately deep. They have a surface layer of very dark grayish-brown, calcareous clay about 10 inches thick. The layer below that is 13 inches thick. It is brown clay in the upper 10 inches and reddish-brown clay in the lower 3 inches. It is underlain by indurated caliche. These soils are moderately slowly permeable. They are on uplands.

The Mereta soils are shallow. The upper part of the surface layer is dark grayish-brown, calcareous clay 8 inches thick. The lower part is brown clay 9 inches thick. It overlies indurated caliche and weakly cemented limestone. These soils are very slowly permeable. They are in shallow depressions along drainage ways in the uplands.

The soils of this association are used mainly for range and wildlife habitat. Most of the soils are not suitable for cultivation. Some areas of deeper soils are cultivated, but these areas make up only 5 percent of the association. A variety of grasses, forbs, and shrubs provides palatable food for cattle, sheep, and goats and for wildlife. This association is well stocked with deer and turkey. Overgrazed areas erode easily, especially on the steeper slopes.

6. Nueces-Patilo-Eufaula association

Deep, nearly level to gently sloping and gently undulating, sandy, noncalcareous soils

This soil association is on broad, eolian plains in the uplands and covers about 6 percent of the county. It is about 28 percent Nueces soils, 16 percent Patilo soils, and 7 percent Eufaula soils. Minor soils making up the remaining 49 percent of the association include Amphion, Duval, Miguel, Poth, Webb, and Wilco soils.

The Nueces soils have a surface layer of fine sand about 34 inches thick. The upper part is pale brown, the middle part is yellowish brown, and the lower part is light yellowish brown. The layer below that is light brownish-gray sandy clay loam. These soils are moderately slowly permeable. They are less sloping and are in slightly lower areas between the Eufaula and Patilo soils and the adjoining association.

The Patilo soils have a surface layer of fine sand about 48 inches thick. It is pale brown in the upper 4 inches and very pale brown in the lower part. The layer below that is mottled, light-gray sandy clay loam. These soils are moderately slowly permeable. They are on dunelike hummocks.

The Eufaula soils have a surface layer of pale-brown fine sand about 28 inches thick. The subsurface layer is light-brown fine sand 28 inches thick. The layer below that is very pale brown fine sand with alternate bands of reddish-yellow sandy loam. These soils are rapidly permeable. They are on dunelike hummocks.

About 85 percent of this association is used for range and wildlife habitat, and 15 percent is cultivated. About 30 percent of the cultivated acreage is irrigated. If properly managed, the soils can produce an abundance of grasses and forbs for cattle. Soil blowing is a hazard if adequate cover is not maintained.

7. Atco-Divot association

Deep, nearly level to gently sloping, loamy, calcareous soils

This soil association is on stream terraces and smooth bottom land and covers about 6 percent of the county. It is about 44 percent Atco soils and 30 percent Divot soils. Among the minor soils making up the remaining 26 percent of the association are Amphion, Castroville, Hanis, Miguel, Orif, Sabenyo, and Victoria soils.

The Atco soils have a surface layer of light brownish-gray loam about 9 inches thick. The upper part of the next layer is grayish-brown sandy clay loam 6 inches thick, and the lower part is very pale brown loam. The underlying material is very pale brown clay loam. The Atco soils are on terraces and old alluvial fans.

The Divot soils have a surface layer about 34 inches thick. It is dark grayish-brown clay loam in the upper 16 inches and dark-brown clay in the lower 18 inches. The layer below is brown clay. These soils occupy flood plains of major streams. In most places Divot soils are in slightly lower areas than Atco soils.

About 75 percent of this association is used for range, and 25 percent is cultivated. A small amount of the cultivated acreage is irrigated. Because in range areas the soils are near streams, they receive enough water to produce an abundance of grasses and forbs. The Divot soils along major streams are well suited to pecan trees.

Descriptions of the Soils

This section describes the soil series and mapping units in Medina County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil

unless otherwise stated. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rock outcrop, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, the pasture and hayland group, and the range site in which the mapping unit has been placed. The page for the description of each range site is listed in the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual *(4)*.

Amphion Series

The Amphion series consists of deep, well-drained, nearly level to gently sloping soils on old stream terraces and in shallow valleys that receive extra runoff.

In a representative profile the surface layer is clay loam about 10 inches thick. It is very dark grayish brown in the upper 5 inches and is very dark gray below that. The next layer extends to a depth of 80 inches. In the upper 16 inches it is very dark gray and dark grayish-brown clay. In the 13 inches below that it is brown clay. Next, for 29 inches, it is very pale brown clay loam and contains about 15 percent calcium carbonate in soft masses and concretions. In the lowermost 12 inches it is yellow clay loam with a few reddish-yellow mottles and contains about 3 percent soft masses and concretions of calcium carbonate.

Permeability is moderately slow, and the available water capacity is high.

Amphion soils are used mostly for crops, but some areas are still in brushy range. They are well suited to irrigation. The principal dryfarmed crops are grain sorghum, small grains, and introduced grasses. Under irrigation, these crops and corn, vegetables, and other truck crops as well as improved pasture and hay crops are grown.

Representative profile of Amphion clay loam, 0 to 1 percent slopes, in an abandoned field, 13.8 miles south on Farm Road 462 from its intersection with U.S. Highway 90 in Hondo, 0.3 mile east on county road, and 100 feet north:

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots; neutral; abrupt, smooth boundary.

A1—5 to 10 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots; fine pores; neutral; clear, smooth boundary.

B1t—10 to 17 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; moderate, fine, angular blocky structure; hard, firm; few patchy clay films on peds; common fine roots; fine pores; neutral; clear, smooth boundary.

B21t—17 to 26 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure parting to moderate, medium, angular blocky; very hard, very firm; clay films on surfaces of peds; few roots; few pores; mildly alkaline; gradual, wavy boundary.

B22t—26 to 39 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure parting to moderate, fine and medium, angular blocky; very hard, very firm; clay films on peds; few fine roots, mainly

between peds; few pores; few old channels partly filled with darker material; few, fine, soft masses and concretions of calcium carbonate, mostly in lower part; calcareous; moderately alkaline; gradual, wavy boundary.

B23tca—39 to 68 inches, very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) when moist; common, coarse, reddish-yellow (7.5YR 7/6) and yellow (10YR 7/6) mottles; moderate, fine and medium, subangular blocky structure; very hard, firm; clay films on peds; very few roots; about 15 percent, by volume, is soft masses and strongly cemented concretions of calcium carbonate; few old channels and cracks filled with darker material; calcareous; moderately alkaline; clear, wavy boundary.

B24t—68 to 80 inches, yellow (10YR 7/6) clay loam, brownish yellow (10YR 6/6) when moist; few, fine and medium, reddish-yellow (7.5YR 6/8) mottles; weak, fine, subangular blocky structure; hard, friable; about 3 percent, by volume, is concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 7 to 16 inches thick, and the B1t horizon is 3 to 12 inches thick. These horizons are very dark grayish brown, very dark gray, dark grayish brown, black, or dark gray. They are neutral or mildly alkaline.

The B21t and B22t horizons are 12 to 30 inches thick. They are clay, clay loam, or sandy clay and are dark gray, grayish brown, brown, or dark grayish brown. They are mildly or moderately alkaline and, in most places, are calcareous in the lower part.

Depth to a prominent zone of calcium carbonate accumulation is 30 to 46 inches. In the B2tca horizon calcium carbonate equivalent is 15 to 50 percent. This horizon is pale brown, very pale brown, dark grayish brown, brown, grayish brown, or yellow. It is clay, clay loam, sandy clay loam, or loam. The upper part contains 3 to 5 percent visible calcium carbonate in soft lumps and concretions. The lower part also commonly contains gypsum crystals. Reddish or yellowish mottles are in the lower part.

AmA—Amphion clay loam, 0 to 1 percent slopes. This nearly level soil is mainly in shallow valleys on old stream terraces and upland plains. It is in rounded to irregularly shaped areas that range from 8 to 400 acres but are generally less than 100 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are soils that are similar to Amphion clay loam but have a slightly more clayey or more sandy surface layer. Also included are Caid and Hanis soils, which are mainly in slightly higher places on the landscape on small, low knolls or ridges.

This soil is used mainly for crops. It is well suited to irrigation where sufficient water is available. Surface runoff is slow, and the hazard of erosion is slight.

Management needs on both dryfarmed and irrigated fields include using fertilized crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIc-1, dryland, and I-1, irrigated; pasture and hayland group 7C; Clay Loam range site.

AmB—Amphion clay loam, 1 to 3 percent slopes. This gently sloping soil is mainly in shallow valleys or on breaks between areas of nearly level Amphion clay loam. It is also on uplands in slightly higher places on the landscape. It is mainly in long, narrow areas of less than 50 acres.

The surface layer is clay loam about 12 inches thick. It is dark gray in the upper 5 inches and very dark gray below that. The layer below that extends to a depth of 60 inches. In the upper 22 inches this layer is dark grayish-brown and grayish-brown clay. In the 12 inches below that it is very pale brown clay loam and about 15 percent calcium carbonate in soft masses and concretions. In the lower part, which is 14 inches thick, the layer consists of very pale brown clay loam that has a few reddish-yellow mottles and about 3 percent visible calcium carbonate.

Included with this soil in mapping are small areas of soils, in lower parts of the landscape, that are similar to Amphion clay loam but have a more clayey surface layer. Also included are soils that have a more sandy surface layer and small areas of Caid and Hanis soils, which are in slightly higher parts of the landscape.

This soil is used for range and cultivated crops. A few areas are irrigated. Surface runoff is medium, and the hazard of water erosion is moderate, especially where the soil is not protected.

Management needs for cultivated fields include using crops that help protect the soil during their growth and furnish sufficient residue to protect and improve the soil between growing seasons. Fertilization, crop rotation, proper use of residue, terraces, and contour tillage help to control erosion, conserve moisture, and maintain tilth and productivity. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, kleingrass, blue panicum, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIe-1, dryland, and IIe-1, irrigated; pasture and hayland group 7C; Clay Loam range site.

Atco Series

The Atco series consists of deep, well-drained, nearly level to gently sloping soils on stream terraces and outwash plains. These soils formed in loamy sediments derived from soft limestone, caliche, and marl. They have a high content of calcium carbonate (fig. 2).

Figure 2.—Area of Atco loam. The light color on the surface indicates that the soil contains a large amount of lime.

In a representative profile the surface layer is light brownish-gray loam about 9 inches thick. The next layer extends to a depth of 54 inches. In the upper 6 inches it is grayish-brown sandy clay loam, and in the lower 39 inches it is very pale brown loam. Beneath this is very pale brown clay loam that extends to a depth of 78 inches.

Permeability is moderate, and the available water capacity is medium.

Atco soils are used for crops and range. The principal dryfarmed crops are small grains, grain sorghum, and introduced grasses. Under irrigation, some of these crops and a small acreage of cotton, corn, vegetables, and other truck crops are grown.

Representative profile of Atco loam, 0 to 1 percent slopes, in an idle field, near Castroville, 0.6 mile south of U.S. Highway 90 on a county road along the Medina River and 150 feet east:

Ap—0 to 9 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine and very fine, subangular blocky and granular structure; slightly hard, friable; few fine roots; common fine pores; few worm casts; few small shell fragments; the surface crust, 1/8 to ¼ inch thick, is slightly lighter in color and slightly more sandy; calcareous; moderately alkaline; clear, smooth boundary.

B21—9 to 15 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; slightly hard; friable; few fine roots; many fine pores; many insect tunnels and worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B22—15 to 31 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable; few fine roots; many fine pores; many insect tunnels and worm casts; many fine threads of segregated calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B23—31 to 54 inches, very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) when moist; weak, fine, subangular blocky structure; slightly hard, friable; few fine roots; common in-sect tunnels and worm casts; common fine threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C—54 to 78 inches, very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) when moist; massive; hard, friable; calcareous; moderately alkaline; gradual, smooth boundary.

The A horizon is 6 to 16 inches thick. It is light brownish gray, grayish brown, brown, or pale brown.

The B2 horizon is 31 to 54 inches thick. It is brown, pale brown, or very pale brown and ranges from loam to clay loam or sandy clay loam. Between depths of 10 and 40 inches, the content of clay ranges from 18 to 30 percent, and the content of calcium carbonate ranges from 50 to 70 percent. The content of calcium carbonate in individual horizons ranges to 80 percent. Visible carbonates vary from a few segregated lime threads to about 5 percent soft lumps or concretions.

Depth to the C horizon ranges from 40 to 60 inches. The C horizon is very pale brown or pale brown, and its content of coarse fragments ranges from less than 1 percent to as much as 50 percent. In some places there is a weakly expressed Cca horizon.

AtA—Atco loam, 0 to 1 percent slopes. This nearly level soil is on broad stream terraces. It is in rounded or elongated areas that range from 10 to 500 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Castroville and Divot clay loam in slight depressions. Also included are small areas of Sabenyo soils on slope breaks to higher terraces or to lower bottom land.

This soil is used mostly for dryland crops, but a small percentage is irrigated. Surface runoff is slow, and the hazard of erosion is slight. The organic-matter content is low. Chlorosis is common in some crops. One method of counteracting chlorosis is mixing manure into the upper part of the surface layer. Surface crusting inhibits the penetration of moisture and the emergence of seedlings.

Management needs in both dryfarmed and irrigated fields include using crops that protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between crops. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and buffelgrass. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIs-1, dryland, and IIs-1, irrigated; pasture and hayland group 7C; High Lime range site.

AtB—Atco loam, 1 to 3 percent slopes. This gently sloping soil is mainly on long, narrow breaks on stream terraces between nearly level Atco loam and soils in higher or lower places. This soil is also on small, rounded knolls within areas of nearly level Atco loam. Areas of this soil range from about 8 to 75 acres.

The surface layer is pale-brown loam about 8 inches thick. The layer below that is sandy clay loam. It is pale brown in the upper 17 inches and very pale brown in the lower 26 inches. Below that is very pale brown clay loam that extends to a depth of 66 inches.

Included with this soil in mapping are small areas of similar soils that have layers of gravelly loam below a depth of 12 inches. Also included are small areas of Sabenyo soils on slope breaks and eroded Atco loam. In the eroded areas there are a few scattered rills and gullies less than 2 feet deep and about 250 feet apart.

Much of the acreage is cultivated, and a few areas are irrigated. Surface runoff is medium, and the hazard of erosion is moderate. If it is not protected, this soil tends to seal over after rains, and a thin surface crust forms.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, Kleberg bluestem, King Ranch bluestem, kleingrass, blue panicum, and buffelgrass. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-1, dryland, and IIe-2, irrigated; pasture and hayland group 7C; High Lime range site.

Austin Series

The Austin series consists of moderately deep, well-drained, gently sloping soils on convex to plane surfaces on erosional uplands. These soils formed in chalk, in interbedded marl and chalk, or in soft limestone.

In a representative profile the surface layer is dark grayish-brown silty clay about 15 inches thick. The layer below that is 20 inches thick. In the upper 14 inches it is grayish-brown silty clay. In the lower part it is brown silty clay that has about 13 percent lime concretions and soft masses. Beneath this, to a depth of 60 inches, is white, very pale brown, and light yellowish-brown, interbedded chalk and marl.

Permeability is moderately slow, and the available water capacity is medium. The content of calcium carbonate is high; this decreases the availability of some plant nutrients and increases the susceptibility to water erosion.

Austin soils are used for crops and range. Suitable crops are small grain and improved bermudagrasses and other introduced and native grasses. A small part of the acreage is in housing developments.

Representative profile of Austin silty clay, 1 to 5 percent slopes, in a cultivated field, 5.5 miles north on Farm Road 471 from its junction with U.S. Highway 90 in Castroville, 4.5 miles east on Farm Road 1957, 0.55 mile north on county road, and 200 feet east:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky and granular structure; hard, firm but crumbly; common medium and fine roots; common worm casts, tunnels, and pores; few fine calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 15 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky and granular structure; hard, firm but crumbly; common fine roots; common worm casts, tunnels, and pores; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

B2—15 to 29 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, subangular blocky structure; hard, firm but crumbly; few fine roots; common worm casts, tunnels, and pores; few fine calcium carbonate concretions; streaks of lighter colored material from the B2Ca horizon; calcareous; moderately alkaline; gradual, wavy boundary.

B2ca—29 to 35 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) when moist; moderate, fine, subangular blocky structure; hard, firm; few fine roots; common worm casts and tunnels; 3 percent fine and medium calcium carbonate concretions; approximately 10 percent soft masses of calcium carbonate and marl material; calcareous; moderately alkaline; gradual, irregular boundary.

C—35 to 60 inches, white (10YR 8/2), very pale brown (10YR 8/4), and light yellowish-brown (10YR 6/4) interbedded chalk and marl.

The A horizon is 10 to 18 inches thick. It is grayish brown or dark grayish brown.

The B horizon is 10 to 22 inches thick and ranges from brown to grayish brown. The calcium carbonate equivalent is 40 to 60 percent in the lower part of this horizon.

Depth to the C horizon ranges from 20 to 40 inches. The C horizon is marl, shale, interbedded shale and marl, soft limestone, or chalk. It ranges from white to very pale brown or light yellowish brown.

AuC—Austin silty clay, 1 to 5 percent slopes. This gently sloping soil is on uplands. It is in irregularly shaped areas that range from 50 to 500 acres but are mostly less than 200 acres.

Included in mapping are small areas of Doss clay loam on low knolls or ridges and Pratley clay.

This soil is used for crops and range. The main crops are small grain, grain sorghum, and introduced grasses. A small acreage is sprinkler irrigated.

Surface runoff is medium, and the hazard of erosion is moderate. This soil is droughty.

Management needs for cultivated fields include using crops that help protect the soil during the growing season and that furnish residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion, conserve moisture, and maintain productivity. A well-designed irrigation system and proper water management are needed on irrigated land. This soil is easy to work.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, and kleingrass. Sudangrass and other introduced grasses are also used for pasture and hay. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-2, dryland, and IIIe-1, irrigated; pasture and hayland group 7C; Rolling Blackland range site.

Brackett Series

The Brackett series consists of shallow, well-drained, undulating to steep soils. These soils formed in interbedded chalky limestone, marl, or shale on erosional uplands.

In a representative profile the surface layer is light brownish-gray loam, about 5 inches thick, that contains a few limestone pebbles and cobbles. The layer below that is pale-yellow loam, 9 inches thick, that has about 5 percent limestone gravel and a few soft lumps or masses of calcium carbonate. Beneath this to a depth of 41 inches is a bed of yellow marl interbedded with cemented platy limestone.

Permeability is moderately slow, and the available water capacity is very low.

Brackett soils are used for range and wildlife habitat. The large amount of calcium carbonate in the soil makes some plant nutrients unavailable. Roadbed material has been mined from open pits in some areas of these soils.

Representative profile of Brackett loam, in an area of Brackett association, undulating, in native pasture, 21.8 miles north on Farm Road 462 from its junction with U.S. Highway 90, 0.6 mile west on county road, 3.6 miles north on county road, and 100 feet east:

A1—0 to 5 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; moderate, fine and medium, subangular blocky and granular structure; hard, friable; common fine roots; about 3 percent limestone pebbles and a few cobbles and larger fragments scattered on the surface; calcareous; moderately alkaline; clear, wavy boundary.

B2—5 to 14 inches, pale-yellow (2.5Y 7/4) loam, light yellowish brown (2.5Y 6/4) when moist; moderate, fine and very fine, subangular blocky structure; hard, slightly firm; many fine roots; about 5 percent, by volume, is subrounded, weakly and strongly cemented limestone fragments as large as 3 inches; few tongues of darker material from the A horizon; few, soft, fine masses or lumps of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

C1—14 to 26 inches, yellow (2.5Y 8/6) marl interbedded with weakly and strongly cemented platy limestone; rock structure cleavage planes are evident in both the limestone and the soil material; few roots; few, soft, fine lumps or masses of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

C2—26 to 41 inches, yellow (2.5Y 8/6) clayey material; few, fine, distinct, brownish-yellow (10YR 6/8) mottles, not caused by wetness; many, soft fine masses or lumps of calcium carbon-ate; calcareous; moderately alkaline.

These soils contain 40 to 80 percent calcium carbonate, excluding fragments larger than 3 inches. The content of coarse fragments in the solum ranges from an insignificant amount of pebble-sized limestone to 35 percent pebbles, by volume.

The A horizon is 3 to 12 inches thick. It ranges from loam to clay loam and is brown, light gray, grayish brown, light yellowish brown, light brownish gray, pale brown, or very pale brown.

The B horizon is 4 to 16 inches thick. It is brown, yellowish brown, light brownish gray, pale brown, light gray, grayish brown, or pale yellow. It ranges from loam to clay loam, and the clay content ranges from 22 to 35 percent.

Depth to the C horizon ranges from 10 to 20 inches. The C horizon consists of limy soil material intermingled with limestone, calcareous silty shale, or marl that has bedding planes. It is light brownish gray, very pale brown, pale yellow, yellow, or

white. The fine earth fraction of this layer is loam or clay loam. In some places there are mottles, but they are not caused by wetness. In many places there is no C2 horizon, and in many places the marl or shale is not evident and the soil mass is underlain by soft or chalky limestone.

BKD—Brackett association, undulating. This association is generally on foot slopes below steeper soils or on ridgetops. It is mostly in irregularly shaped areas of 50 to 250 acres. On some small, isolated hills, the areas are oval or rounded. Slopes range from 1 to 8 percent. The Brackett loam in this association has the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Map-ping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 71 percent Brackett soils and similar soils that are less than 10 inches deep, and about 10 percent Rock outcrop. The remaining 19 percent consists of Doss, Mereta, Real, and Tarrant soils. Small pockets of deeper Castroville and Pratley soils are in narrow valleys. These soils were not mapped separately because their use and management are similar.

The less resistant soft strata of marl, shale, and limy soil material between the more resistant layers of limestone are eroded, and this gives a benchlike or stairstep appearance. The soil varies in depth from the outer edge of the bench to the inner edge and is generally deeper along the inner edge.

These soils are well drained. Surface runoff is moderate, and the hazard of erosion is severe. A good cover of native vegetation is needed to control runoff and erosion. Other management needs are fencing, seeding, controlled grazing, water development, and brush control. Capability unit Vls-1, dryland; not in a pasture and hayland group; Adobe range site.

BRF—Brackett-Rock outcrop association, hilly. This association is on foothills below steeper soils and above the valleys and less sloping Brackett soils. Most areas are broad and range from 40 to 500 acres in size, but some areas on isolated hills are rounded to irregular in shape. Slopes range from 10 to 30 percent.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Map-ping has been controlled well enough, however, for anticipated uses of the soils. This association is about 28 percent Brackett soils, 36 percent similar soils that are slightly shallower, and 11 percent Rock outcrop. The remaining 25 percent consists of Real and Tarrant soils and some small pockets of Doss and Mereta soils. These soils were not mapped separately because their use and management are similar.

The Brackett soils in this association have a surface layer of light brownish-gray clay loam about 6 inches thick. Fine limestone fragments are scattered on the surface and in the soil. The next layer is pale-brown gravelly clay loam, 9 inches thick, and contains about 20 percent pebble-sized limestone fragments. The underlying material, to a depth of 50 inches, is yellow, limy soil material interbedded with white, weakly cemented limestone.

In areas of this association, the landscape typically has a benched or stairstep appearance. The benches are 20 to 100 feet wide and generally circle the steeper hills. The soils range in depth from the outer edge to the inner edge of the bench and are generally deeper along the inner edge.

Surface runoff is rapid, and the hazard of erosion is severe. Management needs include fencing, seeding, grazing control, water development, and brush control.- Brackett part in capability unit VIIs-1, dryland, and Steep Adobe range site; Rock outcrop in capability unit VIIIs-1, dryland, but not in a range site. Not in a pasture and hayland group.

Caid Series

The Caid series consists of deep, well-drained, nearly level to gently sloping soils on old stream terraces. These soils formed in alluvial and eolian materials.

In a representative profile the surface layer is sandy clay loam 13 inches thick. It is dark grayish brown in the upper 6 inches and very dark grayish brown below that. The next layer extends to a depth of 84 inches. In the upper 11 inches it is brown clay loam that has a few visible threads of lime and some lime concretions. In the 11 inches below that it is pale-brown clay loam and contains a few fine, soft masses of lime as well as numerous lime threads and lime concretions. Next, for another 11 inches, it is light yellowish-brown clay loam and about 20 percent soft lumps and cemented concretions of lime. In the lowermost 38 inches it is brownish-yellow clay loam and about 30 percent visible lime concretions and soft masses.

Permeability is moderate, and the available water capacity is medium.

Caid soils are used for crops and range. They are well suited to irrigation. The principal dryfarmed crops are grain sorghum and small grains. Introduced grasses for pasture and hay are also grown.

Representative profile of Caid sandy clay loam, 0 to 1 percent slopes, in a cultivated field, 9.2 miles south on a county road from its junction with U.S. Highway 90 at the old Hondo Air Base; 0.1 mile west on county road, 1.5 miles south on a pasture road past ranch headquarters, 0.2 mile west on field boundary road, and 400 feet south:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky and granular structure; slightly hard, friable; many fine roots; few fine calcium carbonate concretions and few snail shell fragments; thin crust on soil surface; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 13 inches, very dark grayish-brown (10 YR 3/2) sandy clay loam, very dark brown (10YR 2/2) when moist; weak, fine, and medium, subangular blocky structure; hard, friable; many fine roots, fine pores, and old root channels; few fine calcium carbonate concretions and snail shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B21t—13 to 24 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; weak, medium, prismatic structure breaking to moderate, fine and medium, subangular blocky; hard, friable; many fine roots; many fine pores and old root channels; few, thin, patchy clay films on ped faces; few visible lime threads and fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

B22tca—24 to 35 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few roots; few fine pores and old root channels; few clay films on peds; about 5 percent, by volume, is visible fine threads and fine calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

B23tca—35 to 46 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) when moist; moderate, fine and medium, subangular blocky structure; hard, firm; few fine roots; about 20 percent, by volume, is soft lumps and cemented concretions of calcium carbonate; few old root channels filled with darker material; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—46 to 84 inches, brownish-yellow (10YR 6/6) clay loam, yellowish brown (10YR 5/6) when moist; moderate, fine and medium, angular blocky structure; very hard, firm; few patchy clay films on peds; about 30 percent, by volume, is soft masses and cemented concretions of calcium carbonate; few, fine, black-brown concretions; calcareous; moderately alkaline.

The solum is moderately alkaline and calcareous throughout. Depth to a prominent zone of calcium carbonate accumulation is 25 to 40 inches.

The A horizon is 10 to 20 inches thick. It is brown, dark grayish brown, or very dark grayish brown.

The B21t horizon is 10 to 25 inches thick. It is brown, pale-brown, or grayish-brown sandy clay loam or clay loam.

In the B2tca horizon, calcium carbonate equivalent ranges from 15 to 35 percent. This horizon ranges from light yellowish brown, brownish yellow, light brown, or pale brown to reddish yellow and is clay loam or sandy clay loam.

In some places a C horizon is below a depth of 60 inches. It contains a few yellowish sandstone fragments.

CdA—Caid sandy clay loam, 0 to 1 percent slopes. This nearly level soil is mainly on old terraces of major streams. It is in elongated or irregularly shaped areas that range from 15 to 250 acres. The elongated areas generally run parallel to the stream channels. This soil has the profile described as representative of the series.

Included with this soil in mapping are soils that are similar to Caid sandy clay loam but have a slightly more clayey or more sandy surface layer. Also included are Amphion, Atco, and Castroville soils in slight depressions and Hanis soils on low knolls or ridges.

This soil is used mainly for cultivated crops and is well suited to irrigation. Surface runoff is slow, and the hazard of erosion is slight.

Management needs for both dryfarmed and irrigated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land. Fertilization, crop rotation, and proper use of plant residue help to conserve soil moisture and maintain tilth and productivity.

Suitable pasture and hay plants are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIc-1, dryland, and I-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

CdB—Caid sandy clay loam, 1 to 3 percent slopes. This gently sloping soil is generally in elongated areas parallel to stream channels. It is mainly between more level soils on terraces and soils on uplands. The areas range from 10 to 100 acres.

The surface layer is dark grayish-brown sandy clay loam about 18 inches thick. The next layer extends to a depth of 80 inches. This layer in the upper 14 inches is brown sandy clay loam and has a few visible lime threads and fine concretions. In the 12 inches below that, it is light-brown sandy clay loam and about 5 percent calcium carbonate in soft lumps, lime threads, and fine concretions. In the lower part, which is 36 inches thick, the layer consists of reddish-yellow sandy clay loam and 20 to 25 percent soft lumps and fine concretions of calcium carbonate.

Included with this soil in mapping are small areas of similar soils that have a more clayey or more sandy surface layer. Small areas of Amphion and Hanis soils are also included.

This soil is used for range and cultivated crops. A few areas are irrigated. Surface runoff is medium, and the hazard of erosion is moderate.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect the soil and improve tilth between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. In some places grassed waterways are needed to

safely dispose of excess runoff and help control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Range bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-2, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

CdC—Caid sandy clay loam, 3 to 5 percent slopes. This gently sloping soil is on the uplands mainly on long, narrow breaks between stream terraces. The areas are mostly parallel and adjacent to major streams and range from 10 to 75 acres.

The surface layer is dark grayish-brown sandy clay loam about 10 inches thick. The next layer extends to a depth of 76 inches. In the upper part, which is 10 inches thick, this layer is brown sandy clay loam and has a few lime threads and concretions. Below that, for 12 inches, it is pale-brown sandy clay loam and about 5 percent soft lumps and fine concretions of calcium carbonate. In the next 16 inches, it is light yellowish-brown sandy clay loam and about 30 percent soft lumps and fine concretions of calcium carbonate. In the lowermost 28 inches it is brownish-yellow sandy clay loam and about 20 percent calcium carbonate masses and concretions.

Included with this soil in mapping are small areas of similar soils that are less sloping or that have a more clayey or more sandy surface layer. Also included are small areas of Sabenyo soils and small areas of soils that have had about half of their surface layer removed by erosion. There are a few small crossable gullies in some cultivated areas. They can usually be eliminated during cultivation and present little or no hazard to farm equipment.

This soil is used mainly for range or improved pasture, but in some areas it is used for dryfarmed crops. A few small areas are irrigated. The soil is better suited to pasture and hay than to other uses. Surface runoff is medium, and the hazard of erosion is moderate. Chlorosis in some crops reduces yields.

Good management is especially important on this soil to minimize soil loss through erosion. Management needs for cultivated fields include using crops that help protect the soil during their growth, conserve soil moisture, and furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture, and grassed waterways help to safely dispose of excess runoff. A well-designed irrigation system and proper water management are needed on irrigated land (fig. 3). Fertilization is essential in maintaining productivity.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IVe-1, dryland, and IIIe-1, irrigated; pasture and hayland group 7C; Clay Loam range site.

Figure 3.—Constructing a parallel-border irrigation system on the contour. The soil is Caid sandy clay loam, 3 to 5 percent slopes.

Castroville Series

The Castroville series consists of deep, well-drained, nearly level to gently sloping soils on stream terraces in the uplands. These soils formed in calcareous material weathered from limestone.

In a representative profile the surface layer is clay loam 16 inches thick. It is grayish brown in the upper 6 inches and dark grayish brown in the lower 10 inches. The layer below this extends to a depth of 52 inches. In the upper 19 inches it is brown clay loam and clay. In the middle 10 inches it is light-brown clay that has a few lime concretions. In the lower 7 inches it is pink clay and about 10 percent visible concretions and soft masses of lime. Beneath this, to a depth of 84 inches, is pink clay that contains about 5 percent visible concretions and soft masses of lime.

Permeability is moderate, and the available water capacity is high.

These soils are used for crops and native range. They are well suited to dryfarming and irrigation. The principal dryfarmed crops are small grains and grain sorghums. The irrigated crops are small grains, grain sorghums, corn, vegetables, other truck crops, and forage crops.

Representative profile of Castroville clay loam, 0 to 1 percent slopes, in a cultivated field, 3.2 miles north on Stat Highway 173 from its junction with U.S. Highway 90 and 100 feet east of highway:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable; few fine roots; the surface crust is inch thick and is light brownish gray (10YR 6/2) and slightly more sandy; 25 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 16 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky structure; hard, friable; few fine roots, fine pores, and old root channels; 25 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, wavy boundary.

B21—16 to 28 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few fine roots, fine pores, and old root channels; few visible threads of calcium carbonate; few fine limestone fragments; 30 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, wavy boundary.

B22—28 to 35 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) when moist; weak, medium and fine, subangular blocky structure; very hard, firm; few fine pores and old root channels; few visible threads and soft masses of calcium carbonate; few fine limestone fragments; 35 percent calcium carbonate equivalent; calcareous; moderately alkaline; diffuse, wavy boundary.

B23ca—35 to 45 inches, light-brown (7.5YR 6/4) clay, brown (7.5YR 5/4) when moist; weak, medium and fine, subangular blocky structure; very hard, firm; few fine pores; about 5 percent, by volume, is soft masses, threads, films, and weakly cemented concretions of calcium carbonate as large as ¼ inch; 40 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, wavy boundary.

B24ca—45 to 52 inches, pink (7.5YR 7/4) clay, light brown (7.5YR 6/4) when moist; weak, medium and fine, subangular blocky structure; very hard, firm; about 10 percent, by volume, is visible soft masses and weakly cemented concretions of calcium carbonate as large as ½ inch; 50 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, wavy boundary.

Cca—52 to 84 inches, pink (7.5YR 7/4) clay, light brown (7.5YR 6/4) when moist; massive; hard, friable; about 5 percent, by volume, is visible soft masses and weakly cemented concretions of calcium carbonate as large as ½ inch; 55 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The amount of gravel, by volume, is less than 15 percent in the upper 40 inches but increases to 25 or 30 percent below a depth of 40 inches in some places. The content of total carbonates exceeds 20 percent between depths of 10 to 40 inches and increases with depth.

The A horizon is 10 to 20 inches thick. It is brown, grayish brown, or dark grayish brown.

The B horizon is grayish brown, yellowish brown, pale brown, pink, brown, light brown, or very pale brown. The B2 horizon is 13 to 36 inches thick, and the B2ca horizon is 13 to 40 inches thick.

The B and C horizons are clay loam, clay, or silty clay. Visible carbonates in soft masses, fine concretions, and threads make up as much as 5 percent of the B2 horizon and as much as 10 percent of the B2ca and Cca horizons.

Depth to the Cca horizon is 45 to 75 inches. The Cca horizon is pale brown, pink, light yellowish brown, or very pale brown. In some places there are beds of gravel at a depth of more than 6 feet.

CsA—Castroville clay loam, 0 to 1 percent slopes. This nearly level soil is mainly on broad outwash plains or stream terraces. It is typically in elongated or irregularly shaped areas that range from 25 to 500 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are soils that are similar to Castroville soils but are slightly more clayey throughout and soils that are only moderately deep. Also included are a few small areas of Atco and Divot soils in elongated depressions.

This soil is used mainly for crops and is well suited to irrigation. Surface runoff is slow, and the hazard of erosion is slight.

Management needs on both dryfarmed and irrigated fields include using fertilized crops that will help protect the soil during their growth and furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs on pasture include fertilization, weed

control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIc-2, dryland, and I-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

CsB—Castroville clay loam, 1 to 3 percent slopes. This gently sloping soil is on stream terraces mainly on breaks between nearly level Castroville clay loam and soils at a higher elevation. Most areas are long and narrow and are parallel to stream channels. They range from 10 to 100 acres.

The surface layer is clay loam about 14 inches thick. This layer is grayish brown in the upper 7 inches and dark grayish brown below that. The next layer is brown clay loam 18 inches thick. The layer below that is firm, yellowish-brown clay 13 inches thick. Between depths of 45 and 72 inches is brown and light yellowish-brown clay; 2 to 5 percent, by volume, is calcium carbonate in the form of threads, films, or soft lumps and fine concretions.

Included with this soil in mapping are small areas of moderately deep soils and small areas of Atco and Sabenyo soils.

Surface runoff is medium, and the hazard of erosion is moderate.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture, and grassed waterways help to safely dispose of excess runoff. Crop rotation and proper fertilization help to maintain soil productivity. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability unit IIe-2, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Devine Series

The Devine series consists of deep, well-drained, undulating soils on uplands. These soils formed in thick beds of sand and gravel.

In a representative profile the surface layer is 38 inches thick. In the upper 12 inches it is brown sandy loam and about 45 percent gravel. In the lower 26 inches it is light brown sandy loam and about 70 percent gravel. The next layer extends to a depth of 98 inches. In the upper 30 inches it is reddish-brown sandy clay and about 80 percent rounded chert gravel. In the 20 inches below that it is prominently and coarsely mottled dark-red and grayish-brown clay and about 70 percent gravel. In the lower part, which is 10 inches thick, the layer consists of yellowish-red sandy clay loam that has a few shale and sandstone fragments and a few calcium carbonate concretions. Beneath this, to a depth of 120 inches, is weakly consolidated sandstone.

Permeability is moderately slow, and the available water capacity is low.

Almost the entire acreage is used for range and wildlife habitat. A few areas are rootplowed and planted to improved grasses. Gravel is mined in some areas of these soils (fig. 4).

Figure 4.—Profile of Devine gravelly sandy loam. In some areas this soil is an important source of gravel.

Representative profile of Devine gravelly sandy loam, in an area of Devine association, undulating, 14.8 miles south of Hondo on Farm Road 462 from its junction with U.S. Highway 90, 6.3 miles east of Yancey on Farm Road 2200, and 50 feet south, in road cut on south side of road:

A11—0 to 12 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) when moist; weak, fine, subangular blocky and granular structure; hard, very friable; many fine roots; about 45 percent, by volume, is rounded chert pebbles ¼ to 3 inches in diameter; few cobbles; slightly acid; gradual, smooth boundary.

A12—12 to 38 inches, light-brown (7.5YR 6/4) very gravelly sandy loam, brown (7.5YR 5/4) when moist; weak, very fine, sub-angular blocky and granular structure; hard, very friable; common fine roots; about 70 percent, by volume, is rounded chert pebbles ¼ to 3 inches in diameter; few cobbles; slightly acid; clear, smooth boundary.

B21t—38 to 68 inches, reddish-brown (5YR 4/4) very gravelly sandy clay, dark reddish brown (5YR 3/4) when moist; moderate, fine, angular blocky structure; very hard, very firm; few roots; about 80.percent, by volume, is rounded chert pebbles, mainly ¼ to 3 inches in diameter; few cobbles; clay films on peds and coarse fragments; slightly acid; gradual, wavy boundary.

B22t—68 to 88 inches, prominently and coarsely mottled dark-red (2.5YR 3/6) and grayish-brown (10YR 5/2) very gravelly clay; moderate, fine and medium, angular blocky structure; very hard, very firm; clay films on peds and coarse fragments; about 70 percent chert pebbles and cobbles '/4 to 5 inches in diameter; slightly acid; gradual, wavy boundary.

B3t—88 to 98 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate, fine and medium, subangular blocky structure; hard, firm; few fine shale fragments; few sandstone fragments; few calcium carbonate concretions; patchy clay films on peds; slightly acid; clear, wavy boundary.

C—98 to 120 inches, weakly consolidated sandstone; stratified reddish yellow (5YR 6/6) and brownish yellow (10YR 6/6); small pockets of gray shale; less than 5 percent yellowish-red sandy clay loam between some strata; thin seams and pockets of calcium carbonate; sandstone is noncalcareous.

Devine soils contain 35 to 80 percent, by volume, rounded chert or quartzite pebbles and cobbles in the A horizon and 40 to 80 percent in the upper 20 inches of the B2t horizon.

The A horizon is 30 to 50 inches thick. It ranges from brown to light brown and is gravelly or very gravelly sandy loam or loam. Reaction is medium acid to neutral.

The B horizon is 20 to 60 inches thick. It is reddish brown, yellowish red, red, dark reddish brown, light brownish gray, or dark red. In most places it is mottled in shades of red, gray, yellow, and brown. The B horizon is gravelly or very gravelly clay loam, clay, or sandy clay, and the clay content of the soil material in the upper 20 inches ranges from 35 to 50 percent. Reaction is medium acid to mildly alkaline. The B3t horizon commonly contains soft masses and threads of calcium carbonate and fragments of partly weathered shale. Some profiles do not have a B3t horizon.

Depth to the C horizon is 60 inches or more. This horizon is variable; it consists of caliche, weakly consolidated noncalcareous sandstone or shaly clay, or clay loam.

DED—Devine association, undulating. This association consists of gravelly sandy loams on uplands, mainly on low rounded knolls or long narrow ridges. Areas of this association range from 20 to 350 acres. Slopes range from 1 to 8 percent. The Devine soils in this association have the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Map-ping has been controlled well enough, however, for anticipated uses of the soils. This association is about 70 percent Devine soils and similar soils and 20 percent Hindes and Yologo soils. The remaining 10 percent consists of Olmos, Duval, and Nueces soils. Olmos soils are on small, low knolls, and Amphion and Hanis soils are in natural drainage ways that cross Devine soils. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium to rapid. As a result of slope, the hazard of erosion is moderate, but the gravelly surface layer reduces erosion by acting as a mulch to increase water infiltration.

Devine soils are used mainly for range and wildlife habitat. Some areas are mined for road fill.

Thick patches of thorny brush are common on this association, and management needs for pasture include extensive rootplowing and clearing. Other management needs are seeding, fencing, grazing control, and water development. Blue panicum, weeping lovegrass, and buffelgrass are suitable pasture plants, and improved bermudagrass can be grown on some areas. Capability unit IVs-2, dryland; pasture and hayland group 9B; Gravelly Ridge range site.

Dina Series

The Dina series consists of moderately deep, well-drained, gently undulating soils on uplands. These soils formed in gravelly clay and clay loam overlying indurated limestone.

In a representative profile the surface layer is gravelly silt loam about 11 inches thick. It is brown in the upper 3 inches and dark brown below that. The next layer is reddish-brown and dark reddish-brown very gravelly clay 20 inches thick. The underlying material is hard, indurated limestone bedrock that has red gravelly clay in cracks and crevices.

Permeability is moderately slow, and the available water capacity is low.

Nearly all of the acreage is used for range and wildlife habitat.

Representative profile of Dina gravelly silt loam, in an area of Dina association, gently undulating, in native range, 1.3 miles north on State Highway 173 from its junction with U.S. Highway 90 in Hondo, 2.9 miles east on Farm Road 2676, 9.3 miles north on paved county road, and 100 feet west:

A11—0 to 3 inches, brown (7.5YR 4/2) gravelly silt loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, subangular blocky and granular structure; hard, friable; many fine roots; about 20 percent, by volume, is rounded chert pebbles mostly ½ to 2 inches in size; slightly acid; clear, wavy boundary.

A12—3 to 11 inches, dark-brown (7.5YR 3/2) gravelly silt loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, subangular blocky structure; hard, firm; many fine roots; about 25 percent rounded chert pebbles; slightly acid; abrupt, wavy boundary.

B21t—11 to 23 inches, reddish-brown (5YR 4/3) very gravelly clay, dark reddish brown (5YR 3/3) when moist; moderate, fine and very fine, angular blocky structure; very hard, firm; common roots; thin clay films on faces of peds and on coarse fragments; about 75 percent rounded chert pebbles and a few cobbles as large as 6 inches; slightly acid; gradual, wavy boundary.

B22t—23 to 31 inches, dark reddish-brown (2.5YR 3/4) very gravelly clay, dark reddish brown (2.5YR 2/4) when moist; moderate, fine and very fine, angular blocky structure; very hard, firm; common roots; thin clay films on faces of peds and on coarse fragments; about 85 percent rounded and angular chert fragments, mostly smaller than 2 inches, and a few hard limestone and chert fragments as large as 24 inches; slightly acid; abrupt, wavy boundary.

R—31 to 48 inches, white and gray indurated limestone bedrock; coarsely fractured; red gravelly clay in crevices.

The thickness of the solum and the depth to indurated limestone range from 21 to 40 inches. Coarse fragments are angular or rounded chert and limestone pebbles, cobbles, and stones. Chert and limestone that occur as cobbles and stones 6 to 24 inches in diameter can make up 2 to 15 percent, by volume, of any horizon. Reaction is medium acid to mildly alkaline.

The A horizon is 4 to 12 inches thick. It is gravelly loam, silt loam, or clay loam and is dark brown, very dark brown, or dark reddish brown. This horizon is, by volume, about 5 to 50 percent coarse fragments.

The B2t horizon is 18 to 30 inches thick. It is gravelly or very gravelly clay and is dark reddish brown, dark red, dark reddish gray, dusky red, or reddish brown. The B2t horizon is, by volume, 35 to 85 percent coarse fragments.

DNC—Dina association, gently undulating. This association consists of gravelly silt loams on uplands. Areas are slightly rounded to irregularly shaped and range from 30 to 500 acres. Slopes are 1 to 5 percent.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for anticipated uses of the soils. This association is about 70 percent Dina soils and a similar soil that is 15 to 35 percent gravel in the lower part of the profile. The remaining 30 percent consists mainly of Quihi, Speck, and Tarrant soils. Rock crops out in some places. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium, and the hazard of erosion is moderate. Coarse fragments on the surface help reduce erosion and evaporation.

Dina soils are not well suited to cultivation. Nearly all the acreage of this association is used for range and wildlife habitat. Small, isolated areas are in small grains for winter grazing by livestock or deer.

The chief management need is establishing a cover of perennial native grass that increases in quality and quantity and protects the soil from erosion. Grazing should be regulated so that half the current growth, by weight, of desirable grasses is left each year. Capability unit VIs-4, dryland; not in a pasture and hayland group; Redland range site.

Divot Series

The Divot series consists of deep, well-drained, nearly level soils on bottom lands and valleys of major streams. These soils formed in beds of stratified calcareous alluvium transported from areas of limestone.

In a representative profile the surface layer is 34 inches thick. It is dark grayish-brown clay loam in the upper 16 inches and dark-brown clay below. The next layer is brown clay 31 inches thick. Beneath this, to a depth of 94 inches, is light yellowish-brown clay.

Permeability is moderately slow, and the available water capacity is high.

Divot soils are used for crops and range. They are well suited to cultivation if they are protected from flooding. Some areas are irrigated. Dryfarmed and irrigated crops include small grains, grain sorghum, corn, and introduced perennial grasses. Many areas are used for pecan orchards.

Representative profile of Divot clay loam, in native range on the flood plain of Live Oak Creek, 6.3 miles south on Farm Road 462 from its junction with U.S. Highway 90, in Hondo, 0.8 miles east on county road, and 100 feet south:

A11—0 to 16 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky and medium granular structure; hard, slightly firm; common fine roots; few fine and very fine calcium carbonate concretions; few snail shells; calcareous; moderately alkaline; gradual, smooth boundary.

A12—16 to 34 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; moderate, fine and medium, subangular blocky structure; hard, slightly firm; few roots; few films and threads of calcium carbonate visible when dry; few fine limestone fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B2—34 to 65 inches, brown (10YR 5/3) clay; dark brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few fine pores and old root channels; common visible threads and few soft masses of calcium carbonate; few fine limestone fragments; calcareous; moderately alkaline; diffuse, smooth boundary.

C—65 to 94 inches, light yellowish-brown (10YR 6/4) clay, yellowish brown (10YR 5/4) when moist; massive; hard, firm; few visible threads and soft masses of calcium carbonate; calcareous; moderately alkaline.

Water-rounded limestone and chert fragments make up as much as 15 percent of the soil mass. In many places these are gravelly strata below a depth of 40 inches, most commonly between depths of 6 and 20 feet. These soils are typically calcareous and moderately alkaline, but in some places the All horizon is noncalcareous and mildly alkaline.

The A horizon is 16 to 50 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, or brown. The B horizon is 10 to 40 inches thick. It ranges from very dark grayish brown to brown. The C horizon ranges from grayish brown to light yellowish brown. In some places the soil is moist much of the time below a depth of 6 feet.

Do—Divot clay loam. This soil is on flood plains and alluvial fans of streams. It is mostly in long, narrow areas parallel to the stream channels. The areas range from 25 to 250 acres. Slopes are 0 to 1 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are Atco, Castroville, and Sabenyo soils on low knolls. Orif soils are included in some places next to the stream channel, and Victoria soils are included in some depressions.

This soil is suited to irrigation. Surface runoff is slow, and the soil is flooded for brief periods about once in 5 to 20 years. The hazard of erosion is slight, although some scouring or soil deposition occurs during the floods.

Management needs on both dryfarmed and irrigated fields include using fertilized crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, Gordo bluestem, and other introduced grasses. Management needs for pasture include fertilization, control of weeds and plant diseases, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIc-3, dryland, and I-3, irrigated; pasture and hayland group 1C; Clayey Bottomland range site.

Dp—Divot clay loam, frequently flooded. This soil is on flood plains of major streams, mainly adjacent and parallel to stream channels. It is in slightly lower areas closer to the stream channel than other Divot soils. In some places it is on low mounds. Areas range from 25 to 150 acres. Slopes are 0 to 1 percent.

The upper part of the surface layer is dark grayish-brown clay loam 15 inches thick. The lower part is dark grayish-brown clay 27 inches thick. Beneath this, to a depth of 75 inches, is brown clay loam.

Included with this soil in mapping are small areas of Atco, Castroville, Orif, and Sabenyo soils. Also included are soils that are very similar to Divot soils but are slightly less clayey below the surface layer.

This soil is used mainly for range and wildlife habitat. Surface runoff is slow, and the soil is frequently flooded. The hazard of erosion is slight, although some scouring occurs once in 1 to 5 years during the floods.

The soil is suited to pasture and hay. Because of flooding, only the areas below dams are suited to crops. A few areas are used for pecan orchards, and some protected areas are used for picnic and recreation facilities.

Suitable pasture and hay plants include improved bermudagrasses, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and other introduced grasses. Management needs for pasture include proper fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability unit Vw-1, dryland; pasture and hayland group 1C; Clayey Bottomland range site.

Doss Series

The Doss series consists of shallow, well-drained, gently undulating soils on uplands. These soils formed in calcareous marl and weakly cemented limestone.

In a representative profile the surface layer is dark grayish-brown clay loam about 10 inches thick. The next layer is 8 inches thick. It is brown clay and has many soft masses and lumps of calcium carbonate. Beneath this, to a depth of 36 inches or more, is weakly cemented limestone.

Permeability is moderately slow, and the available water capacity is low.

Doss soils are used for crops and range. A few isolated spots are sprinkler irrigated. The principal crops are grain sorghum and small grains, and introduced grasses are grown for hay and pasture.

Representative profile of Doss clay loam, in an area of Doss association, gently undulating, in native pasture, 5.5 miles north on Farm Road 471 from its junction with U.S. Highway 90 in Castroville, 4.1 miles east on Farm Road 1957, and 320 feet north:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, subangular blocky and granular structure; many fine and medium roots; common fine pores; about 2 percent is fine and very fine weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

B2ca—10 to 18 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common pores and insect tunnels; about 10 percent is soft masses and lumps of calcium carbonate; few, angular, weakly cemented limestone fragments as large as ½ inch; calcareous; moderately alkaline; clear, smooth boundary.

C—18 to 36 inches, very pale brown (10YR 8/4) weakly cemented limestone interbedded with silty clay, very pale brown (10YR 7/4) when moist; platy in the upper 2 inches, massive below with a hardness of less than 3 on Mohs scale; calcareous; moderately alkaline.

The solum is 11 to 20 inches thick. The A horizon is 7 to 12 inches thick. It is brown, dark grayish brown, or very dark grayish brown. The A and B horizons are silty clay, silty clay loam, clay, or clay loam. Pebble-to cobble-sized limestone fragments make up 1 to 10 percent of the A and B horizons. The B horizon is 4 to 13 inches thick. It is reddish brown, brown, or yellowish brown. The calcium carbonate equivalent is 40 to 50 percent. In most places the C horizon consists of soft, limy soil material of clayey texture interbedded with weakly cemented or chalky limestone. Some profiles have a Cca horizon 2 to 4 inches thick.

DSC—Doss association, gently undulating. This association is in rounded to irregularly shaped areas of 10 to 150 acres. Slopes range from 1 to 5 percent.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 65 percent Doss clay loam and 14 percent Austin silty clay. The remaining 21 percent consists of Brackett, Mereta, and Real soils. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium, and the hazard of erosion is moderate. A thin surface crust forms if the soils are not protected. The crust inhibits the infiltration of water and the emergence of seedlings. These soils are suited to crops, but chlorosis is common in some crops.

Among the management needs on cultivated fields are fertilization and using crops that help protect the soil during the growing season and that furnish sufficient residue to conserve moisture, maintain tilth and productivity, and protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. Grassed waterways help to carry off excess water and control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, sideoats grama, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-3, dryland, and IIIe-2, irrigated; pasture and hayland group 13A; Shallow, Edwards Plateau, range site.

Duval Series

The Duval series consists of deep, well-drained, nearly level to gently sloping soils on uplands. These soils formed in weakly consolidated sandstone or interbedded sandstone and sandy clay loam.

In a representative profile the surface layer is brown fine sandy loam about 10 inches thick. The next layer is sandy clay loam 40 inches thick. It is reddish brown in the upper 7 inches and red below. Beneath this to a depth of 50 inches is weakly consolidated sandstone.

Permeability is moderate, and the available water capacity is medium.

Duval soils are used for crops, range, and wildlife habitat. They are well suited to cultivation and to a variety of crops, including small grains, grain sorghum, peanuts, and improved bermudagrass and other introduced grasses. Some vegetables, corn, and other truck crops are grown under irrigation.

Representative profile of Duval fine sandy loam, 0 to 1 percent slopes, in range, 13.9 miles south on Farm Road 462 from its junction with U.S. Highway 90, 3.2 miles west of Yancey on Farm Road 2200, 0.05 mile southwest on county road, then 0.3 mile southeast on pasture road:

A1—0 to 10 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, fine and medium, subangular blocky and granular structure; slightly hard, very friable; medium acid; clear, smooth boundary.

B1t—10 to 17 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak prismatic structure breaking to weak, fine and medium, subangular blocky; hard, friable; many fine roots, fine pores, and old root channels; clay bridges between sand grains; slightly acid; clear, smooth boundary.

B21t—17 to 26 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots, fine pores, and old root channels; few patchy clay films on peds and in pores; slightly acid; gradual, wavy boundary.

B22t—26 to 44 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; few roots, fine pores, and old root channels; patchy clay films on ped surfaces and clay bridging; few reddish-brown sandstone fragments as large as 1 inch, and mainly in lower part; neutral; clear, wavy boundary.

B23t—44 to 50 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) when moist; moderate, fine, subangular blocky structure; hard, friable; few pores; clay bridgings between sand grains; about 20 percent is weakly consolidated reddish-brown and yellow sandstone fragments; neutral; abrupt, wavy boundary.

C—50 to 65 inches, weakly consolidated sandstone; stratified yellow (10YR 7/8) and dark reddish brown (5YR 3/3); small pockets and thin seams of calcium carbonate; about 5 percent yellowish-red sandy clay loam between some strata; sandstone is noncalcareous.

The solum is 40 to 60 inches thick.

The A horizon is 10 to 20 inches thick. It is fine sandy loam or loamy fine sand and is yellowish red, reddish brown, brown, or light brown. Reaction is slightly acid or neutral.

The Bt horizon is red, reddish brown, reddish yellow, or yellowish red. The B1t horizon, 4 to 18 inches thick, is sandy loam or sandy clay loam. Reaction is slightly acid or neutral. The B1t horizon is lacking in some places. The B2t horizon, 18 to 30 inches thick, is sandy loam or sandy clay loam. Reaction is neutral or mildly alkaline. The B3t horizon is 3 to 12 inches thick, but it is lacking in some profiles.

Some profiles have a Cca horizon, 1 to 6 inches thick, below a depth of 35 inches. This horizon is reddish to yellowish sandy clay loam or fine sandy loam and contains fragments of sandstone. It is as much as 10 percent, by volume, calcium carbonate in soft lumps and concretions.

DuA—Duval fine sandy loam, 0 to 1 percent slopes. This nearly level soil is mainly on plains and narrow drainageways in the uplands. It is generally in rounded or irregularly shaped areas of 10 to 175 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few areas of soils that have sandstone or caliche within a depth of 40 inches. Also included are small areas of Amphion, Hanis, Miguel, and Webb soils, generally in lower places on the landscape. A few small areas of soil that contain as much as 15 percent rounded chert fragments and a few eroded spots are also included.

Surface runoff is slow. The hazards of water erosion and soil blowing are slight.

Management needs on both dryfarmed and irrigated fields include using fertilized crops that help protect the soil from blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, weeping lovegrass, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-2, dryland, and I-4, irrigated; pasture and hayland group 8C; Sandy Loam range site.

DuB—Duval fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on uplands. It is generally in rounded to irregularly shaped areas of 20 to 200 acres.

The surface layer is reddish-brown fine sandy loam about 11 inches thick. The next layer is 43 inches thick. It is red, friable sandy clay loam and has a few limy concretions in the lower 10 inches. Below that is yellowish-red sandy clay loam 8 inches thick that has about 2 percent limy concretions. The underlying material is interbedded, yellowish-red sandy clay loam and sandstone. A few areas are calcareous and have few eroded spots.

Included with this soil in mapping are spots of Duval loamy fine sand and Hindes, Lacoste, and Webb soils on low knolls and ridges. Also included are a few areas of calcareous soils and a few eroded spots.

Surface runoff is medium. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Management needs for cultivated fields include using crops that help protect the soil from blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. In some places grassed waterways are needed to safely dispose of excess runoff. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, weeping lovegrass, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-4, dryland, and IIe-3, irrigated; pasture and hayland group. 8C; Sandy Loam range site.

DwC—Duval loamy fine sand, 0 to 5 percent slopes. This nearly level to gently sloping soil is on uplands. It is mostly in rounded or irregularly shaped areas of 10 to 250 acres.

The surface layer is brown or reddish-brown loamy fine sand about 18 inches thick. Below this is yellowish-red sandy loam 6 inches thick. The next layer is red

sandy clay loam 18 inches thick. Beneath this is yellowish-red sandy clay loam, 4 inches thick, that contains common sandstone fragments. Weakly consolidated, yellow and reddish-brown sandstone is below a depth of 46 inches.

Included with this soil in mapping are small areas of Duval fine sandy loam in slightly lower areas and Nueces and Poth soils in slightly higher areas. Also included are a few larger areas of soils that are similar to Duval soils but have a surface layer more than 20 inches thick or are more clayey below the surface layer.

Surface runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. Water enters the surface easily, but the downward movement of water and air and the growth of plant roots are moderately restricted.

Management needs for cultivated fields include fertilization and using crops that help protect the soil during their growth and that furnish sufficient residue to control soil blowing, conserve moisture, and maintain and improve soil tilth and productivity. Stripecropping also helps to control soil blowing. A well-designed irrigation system and proper water management are needed on irrigated land.

Some old fields are no longer cultivated and have been reseeded to several varieties of lovegrass and buffelgrass. Other suitable pasture and hay plants include improved bermudagrasses, kleingrass, blue panicum, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important.

Some areas of range have been invaded by thorny brush. When the brush and other flowering plants begin to bloom early in spring, bees produce sufficient quantities of honey for commercial use (fig. 5). Capability units IIIe-5, dryland, and IIIe-3, irrigated; pasture and hayland group 9A; Sandy range site.

Figure 5.—Beehives in an area of Duval loamy fine sand where thorny brush has invaded.

Eufaula Series

The Eufaula series consists of deep, somewhat excessively drained, gently undulating soils on uplands. These soils formed in thick deposits of sandy material.

In a representative profile the surface layer is fine sand about 28 inches thick. It is brown in the upper 3 inches and pale brown below. The next layer is light-brown fine sand 28 inches thick. The layer below this, to a depth of 110 inches, is very pale brown fine sand and alternate bands of reddish-yellow sandy loam.

Permeability is rapid, and the available water capacity is low. Runoff is very slow.

Eufaula soils are used mainly for range. A few areas are used for peanuts, watermelons, and improved pasture. Most of the crops and improved pastures are irrigated.

In Medina County, Eufaula soils are mapped only in an association with Patilo soils.

Representative profile of Eufaula fine sand, in an area of Patilo-Eufaula association, gently undulating, 1 mile south of Devine on State Highway 173, in a sand pit just west of the highway:

A11—0 to 3 inches, brown (10YR 5/3) fine sand, dark brown (10YR 4/3) when moist; single grained; loose; many fine roots; medium acid; clear, smooth boundary.

A12—3 to 28 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grained; loose; fine roots in the upper 10 to 12 inches; medium acid; diffuse, wavy boundary.

A2—28 to 56 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grained; loose; medium acid; abrupt, wavy boundary.

A2 and B2t—56 to 110 inches, very pale brown (10YR 8/3) fine sand, pale brown (10YR 6/3) when moist (A2); single grained; slightly hard and loose; medium acid; lamellae of reddish-yellow (5YR 6/6) sandy loam, yellowish red (5YR 5/6) when moist (B2t); the lamellae are massive; very hard, very friable; wavy and discontinuous, ¼ to ½ inch thick, and 2 to 6 inches apart; clay bridgings between sand grains in lamellae; slightly acid.

The A1 horizon is 6 to 28 inches thick. It is brown, dark brown, dark grayish brown, pale brown, or pink. It is medium acid to neutral. The A2 horizon is light brown, pinkish gray, or very pale brown. It is medium acid to neutral.

Depth to the banded A2 and B2t horizon ranges from 40 to 110 inches. The A2 part of this horizon is pinkish-gray to very pale brown fine sand. The lamellae of B2t material are 1/8 to 1 inch thick and are fine sandy loam to loamy fine sand. The A2 and B2t horizon is slightly acid to strongly acid.

Hanis Series

The Hanis series consists of deep, well-drained, nearly level and gently sloping soils on uplands. These soils formed in calcareous sandy clay and sandy clay loam.

In a representative profile the surface layer is dark-brown sandy clay loam about 9 inches thick. The next layer extends to a depth of 72 inches. In the upper 16 inches it is brown and reddish-brown sandy clay. In the 12 inches below that it is red sandy clay. In the next 9 inches it is yellowish-red sandy clay and about 5 percent calcium carbonate masses. In the lowermost 26 Inches it is reddish-yellow sandy clay loam and about 10 percent calcium carbonate concretions and soft masses.

Permeability is moderately slow, and the available water capacity is high.

Hams soils are used for crops, range, and wildlife habitat. They are well suited to irrigation where suitable water is available. The principal dryfarmed crops are grain sorghum, small grains, and introduced grasses. Under irrigation, these crops and corn, vegetables, and other truck crops are grown.

Representative profile of Hanis sandy clay loam, 0 to 1 percent slopes, in a cultivated field, 14.8 miles south of U.S. Highway 90 on Farm Road 462, 2 miles east on Farm Road 2200, then 1 mile south and east on county road and 700 feet south of the road:

Ap—0 to 4 inches, dark-brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky and weak, medium, granular structure; slightly hard, friable; neutral; abrupt, smooth boundary.

A1—4 to 9 inches, dark-brown (7.5YR 4/2) sandy clay loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, subangular blocky and moderate, medium, granular structure; hard, friable; neutral; clear, smooth boundary.

B1t—9 to 15 inches, dark reddish-brown (5YR 3/3) sandy clay, dark reddish brown (5YR 2/3) when moist; moderate, medium, blocky structure; hard, firm; common fine roots; few fine pores; thin patchy clay films on peds; neutral; gradual, smooth boundary.

B21t—15 to 25 inches, reddish-brown (5YR 4/3) sandy clay, dark reddish brown (5YR 3/3) when moist; moderate, fine and medium, blocky structure; very hard, firm; few fine roots and pores; thin patchy clay films on peds; mildly alkaline; gradual, wavy boundary.

B22t—25 to 37 inches, red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) when moist; few dark reddish-brown (5YR 3/4) streaks as much as 2 millimeters wide; moderate, fine, blocky structure; very hard, very firm; few roots and fine pores; clay films on peds; few calcium carbonate concretions in lower few inches; noncalcareous matrix; moderately alkaline; gradual, smooth boundary.

B31ca—37 to 46 inches, yellowish-red (5YR 5/8) sandy clay, yellowish red (5YR 4/8) when moist; moderate, medium, subangular blocky structure; hard, firm; patchy clay films on peds; about 5 percent, by volume, is fine concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B32ca—46 to 72 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) when moist; weak, medium, subangular blocky structure; hard, friable; few patchy clay films; few iron and manganese concretions; about 10 percent, by volume, is soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The A and B1t horizons are dark brown, very dark grayish brown, or dark reddish brown. They range from slightly acid to mildly alkaline. The A horizon is 6 to 12 inches thick. The B1t horizon is clay, sandy clay, or sandy clay loam, and it is 4 to 12 inches thick.

The B2t horizon is 16 to 36 inches thick. It is brown, dark brown, red, reddish brown, or dark reddish brown and is sandy clay or clay. In the upper part it is slightly acid to mildly alkaline and noncalcareous, and in the lower part it is moderately alkaline and calcareous.

Secondary calcium carbonate is at a depth of 28 to 48 inches.

The B3 horizon is brown, reddish brown, reddish yellow, strong brown, red, or yellowish red. It is sandy clay loam or sandy clay and 5 to 30 percent visible threads, concretions, and soft masses of calcium carbonate.

HaA—Hanis sandy clay loam, 0 to 1 percent slopes. This nearly level soil is mainly on broad, smooth, upland plains and old stream terraces. It is in rounded to irregularly shaped areas of 10 to 250 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are soils that have a slightly redder surface layer and spots of Amphion, Caid, and Webb soils.

Surface runoff is slow, and the hazard of erosion is slight.

Management; needs for both dryfarmed and irrigated fields include using fertilized crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, Gordo bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs on pasture include fertilization, weed

control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIc-1, dryland, I-1, irrigated; pasture and hayland group 7C; Clay Loam range site.

HaB—Hanis sandy clay loam, 1 to 3 percent slopes. This gently sloping soil is on uplands, mainly between more level soils and soils at a higher elevation. It is also on breaks along narrow drainageways and in shallow valleys. It is in rounded or irregularly shaped areas of 10 to about 300 acres.

The surface layer is dark grayish-brown sandy clay loam about 7 inches thick. The layer below that extends to a depth of 62 inches. In the upper 10 inches it is dark-brown sandy clay loam. In the next 15 inches it is dark-brown sandy clay. In the next 14 inches it is brown sandy clay loam and 3 to 5 percent calcium carbonate concretions. In the lowermost 16 inches it is strong-brown sandy clay loam and about 15 percent, by volume, calcium carbonate concretions.

Included with this soil in mapping are soils that have slightly redder surface layers. Also included in some places are small spots of Amphion, Caid, and Webb soils.

Surface runoff is medium, and the hazard of erosion is moderate.

Management needs for cultivated fields include fertilization and using crops that help protect the soil during their growth and that furnish sufficient residue to conserve moisture, and maintain tilth and productivity and protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. In some places grassed waterways are needed to dispose of excess runoff safely. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, Gordo bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIe-1, dryland, and IIe-1, irrigated; pasture and hayland group 7C; Clay Loam range site.

Hindes Series

The Hindes series consists of moderately deep, well-drained, gently sloping to sloping and gently undulating to undulating soils on uplands. These soils formed in very gravelly, clayey and loamy material.

In a representative profile the surface layer is about 4 inches thick. It is dark reddish-brown gravelly sandy clay loam and about 45 percent, by volume, chert gravel. The next layer is dark reddish-brown very gravelly clay 26 inches thick. It is about 65 percent chert gravel in the upper part and about 80 percent in the lower part. Below this, to a depth of 40 inches, is soft, pink caliche of about clay loam texture.

Permeability is moderately slow, and the available water capacity is low.

Nearly all the acreage is used for range and wildlife habitat. A few areas have been root-plowed and used for improved varieties of pasture grasses.

Representative profile of Hindes gravelly sandy clay loam, in an area of Hindes association, gently undulating, in native range, 7.6 miles south and west on county road from its junction with U.S. Highway 90 at the old Hondo Air Base, and 200 feet south:

A1—0 to 4 inches, dark reddish-brown (5YR 3/2) gravelly sandy clay loam, dark reddish brown (5YR 2/2) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots; about 45 percent, by volume is rounded chert pebbles, mainly ½ to 2 inches in size; slightly acid; clear, wavy boundary.

B21t—4 to 11 inches, dark reddish-brown (5YR 3/2) very gravelly clay, dark reddish brown (5YR 2/2) when moist; moderate, fine, blocky structure; very hard, very firm; many fine roots; about 65 percent rounded chert pebbles, mainly 2 inches in diameter; clay films on peds and coarse fragments; neutral; clear, wavy boundary.

B22t—11 to 30 inches, dark reddish-brown (2.5YR 3/4) very gravelly clay, dark reddish brown (2.5YR 2/4) when moist; very hard, firm; about 80 percent rounded chert pebbles, mainly less than 2 inches; few roots; clay films on peds and coarse fragments; neutral; abrupt, wavy boundary.

Cca—30 to 40 inches, pink (7.5YR 8/4) caliche, of about clay loam texture, pink (7.5YR 7/4) when moist; massive; few fine chert pebbles; calcareous; moderately alkaline.

The solum is 25 to 40 inches thick. The coarse fragments are mainly waterworn chert pebbles and cobbles.

The A horizon is 4 to 12 inches thick. It is dark brown, reddish brown, dark reddish brown, very dark reddish brown, or brown and is sandy clay loam, loam, clay loam, or fine sandy loam. The content of coarse fragments, by volume, ranges from 5 to 50 percent. Reaction ranges from slightly acid to mildly alkaline.

The Bt horizon is gravelly or very gravelly clay or clay loam. It contains 35 to 80 percent, by volume, rounded pebbles, gravel, and cobbles. Reaction ranges from slightly acid to mildly alkaline, but in some places the lower part of the B22t horizon contains threads or soft masses of calcium carbonate. The B21t horizon is 6 to 14 inches thick and is dark brown, reddish brown, or dark reddish brown. The B22t horizon is 6 to 23 inches thick and is brown or dark reddish brown.

The Cca horizon is mostly weakly cemented caliche but ranges to pink limy soil material or weakly consolidated sandstone that has common seams of calcium carbonate.

HNC—Hindes association, gently undulating. This association consists of gently undulating, gravelly sandy clay loams on low gravelly ridges of the uplands. Areas are as much as several hundred acres in size. Slopes range from 1 to 5 percent. The Hindes gravelly sandy clay loam in this association has the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is 55 percent Hindes soils, 20 percent Yologo soils, and 10 percent Devine soils. The remaining 15 percent consists of Lacoste, Olmos, and Webb soils. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium, and the hazard of erosion is moderate. The gravelly surface reduces erosion by acting as mulch that increases water intake and conserves soil moisture. The lack of moisture is a limitation to the use of these soils for grass and forage.

Hindes soils are not well suited to cultivation because of the amount of coarse fragments in the surface layer. Thick patches of thorny brush commonly grow on range in this association. Management needs include clearing the brush by root-plowing or other means and reseeding to improved pasture grasses.

Blue panicum, buffelgrass, kleingrass, King Range bluestem, Kleberg bluestem, and sideoats grama are the main pasture plants. Grazing should be regulated so that half the current growth, by weight, of desirable grasses is left each year. Fencing and water development are also important management needs. Capability unit VIs-3, dryland; not in a pasture and hayland group; Gravelly Ridge range site.

Kavett Series

The Kavett series consists of shallow, well-drained, undulating soils on uplands. These soils formed in a clayey mantle overlying indurated caliche and limestone.

In a representative profile the surface layer is clay about 14 inches thick. The upper part is very dark grayish brown and 10 percent limestone fragments of stone, pebble, and cobble size. The lower part is brown and about 15 percent limestone fragments. Below that is indurated caliche, 2 inches thick, that rests abruptly on hard fractured limestone bedrock.

Permeability is moderately slow, and the available water capacity is low.

Kavett soils are used mainly for range and wildlife habitat. A few isolated spots are in dryfarmed small grains that are used mainly for winter grazing by livestock and deer.

Representative profile of Kavett clay, in an area of Kavett-Tarrant association, undulating, in native range, 2.8 miles north on Farm Road 1796 from its junction with U.S. Highway 90 in D'Hanis, 1.1 miles west on a pasture road across Seco Creek, and 0.4 mile north and 50 feet west:

A11—0 to 7 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) when moist; moderate, fine, subangular blocky and granular structure; very hard, firm; many fine roots; few fine and very fine limestone fragments and about 10 percent limestone fragments of stone, cobble, and pebble size; stone fragments are tilted at random; calcareous; moderately alkaline; clear, smooth boundary.

A12—7 to 14 inches, brown (10YR 4/3) clay, dark brown (10YR 3/3) when moist; moderate, fine and very fine, angular and subangular blocky structure; firm but crumbly; common fine roots; few fine pores and insect tunnels; common fine and very fine limestone fragments and about 15 percent fragments of gravel, cobble, and stone size; calcareous; moderately alkaline; abrupt, smooth boundary.

Ccam—14 to 16 inches, pinkish-white (7.5YR 8/2) indurated caliche, fractured into plates 6 to 12 inches across; brown (10YR 4/3) clay in cracks and crevices; calcareous; moderately alkaline; abrupt, wavy boundary.

R—16 to 20 inches, hard limestone that is coarsely fractured.

The thickness of the solum and depth to indurated caliche ranges from 11 to 20 inches.

The A horizon is silty clay or clay. The All horizon is 5 to 10 inches thick and ranges from dark brown through very dark grayish brown. The A12 horizon is 5 to 10 inches thick and ranges from dark grayish brown or brown to reddish brown.

The Ccam horizon is 1 to 6 inches thick and ranges from strongly cemented to indurated.

The R horizon ranges from hard limestone to interbedded limestone, chalk, and marl.

In some areas of these soils, stones cover 5 to 15 percent of the surface. The stones are tilted at random and are mixed with limestone fragments of pebble and cobble size.

KAD—Kavett-Tarrant association, undulating. This association consists mainly of shallow clays and cobbly clays on uplands, mainly between the steeper limestone hills and the drainageways. The areas are irregularly shaped but are generally elongated. They range from 20 to 250 acres. Slopes range from 1 to 8 percent.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Map-ping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 57 percent Kavett soil and

about 24 percent Tarrant soils and very similar soils. The remaining 19 percent consists of Doss, Mereta, Pratley, and Real soils. These soils were not mapped separately because their use and management are similar.

The Tarrant soil has a surface layer of grayish-brown cobbly clay about 6 inches thick. The next layer is dark-brown cobbly clay about 6 inches thick. Below that is fractured limestone that extends to a depth of 22 inches.

Surface runoff is medium, and the hazard of erosion is moderate. The coarse fragments on the surface reduce erosion by slowing runoff, increasing water infiltration, and reducing evaporation.

These soils are not suited to cultivation because of the amount of coarse fragments and rock outcrops. Nearly all areas are used for range and wildlife habitat. Small isolated spots are in small grain used for winter grazing by livestock and game.

Seeding with King Ranch bluestem (fig. 6), side-oats grama, or other improved pasture grasses is needed in some places. Among management needs are brush control, cross fencing, and water development. Kavett part in capability unit VIs-2, dryland, and Shallow, Edwards Plateau, range site; Tarrant part in capability unit VIIs-3, dryland; and Low Stony Hill range site. Not in a pasture and hayland group.

Figure 6.—An area of Kavett-Tarrant association, undulating, where King Ranch bluestem has been seeded.

Kincheloe Series

The Kincheloe series consists of deep, somewhat excessively drained, strongly sloping to steep soils on valley walls or side slopes in the uplands. These soils formed in clayey material weathered from thick beds of calcareous shale, shaly clay, and marl.

In a representative profile the surface layer is grayish-brown clay about 4 inches thick. The next layer is light yellowish-brown clay about 20 inches thick. Below that is mottled olive-yellow and pale-yellow clayey shale about 14 inches thick. Beneath this, to a depth of 72 inches, is yellow and light-gray clayey shale that has thin strata of weakly consolidated sandstone and layers or pockets of gypsum.

Permeability is very slow, and the available water capacity is medium. Surface runoff is rapid.

Kincheloe soils are used for range and wildlife habitat. A few areas have been cleared and used for improved bermudagrass. Other areas are mined for clay used in manufacturing bricks.

Representative profile of Kincheloe clay, in an area of Kincheloe soils, 10 to 30 percent slopes, 2.8 miles north on Farm Road 1796 from its junction with U.S. Highway 90 in D'Hanis, 1 mile west and 0.1 mile south on pasture road, and about 200 feet east of road at midpoint of steep valley wall adjacent to Seco Creek:

A1—0 to 4 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; many fine roots; common fine pores and insect tunnels; few, scattered, rounded chert pebbles and cobbles on surface; calcareous; moderately alkaline; gradual, wavy boundary.

B2—4 to 24 inches, light yellowish-brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) when moist; few, fine and medium, distinct, mottles or splotches of yellow (2.5Y 7/6), common in the lower part; moderate, fine and medium, angular blocky structure; very hard, very firm, very sticky and plastic; few roots; few fine pores and old insect tunnels; few dark streaks along old root channels; calcareous; moderately alkaline; gradual, smooth boundary.

C1—24 to 38 inches, prominently and coarsely mottled olive-yellow (2.5Y 6/6) and pale-yellow (2.5Y 7/4) clayey shale; weak, blocky, rock structure; extremely hard, extremely firm; few roots in crevices; few soft masses of calcium carbonate; few gypsum crystals; few dark streaks along old root channels; calcareous; moderately alkaline; clear, wavy boundary.

C2—38 to 72 inches, yellow (2.5Y 7/6) and light-gray (2.5Y 7/2) clayey shale; massive; extremely hard, extremely firm; thin strata and small pockets of gypsum crystals; thin strata of weakly consolidated sandstone; few calcium carbonate concretions; calcareous; moderately alkaline.

The thickness of the solum and depth to unweathered shale ranges from 20 to 40 inches. These soils are typically moderately alkaline and calcareous throughout, but in a few spots they are noncalcareous in the upper few inches. Limestone, sandstone, or chert fragments ranging from pebble to cobble size are on the surface in some places and range from a few to 15 percent.

The A horizon, 1 to 10 inches thick, is grayish-brown to pale-olive clay or clay loam. In some places it has been eroded away.

The B2 horizon is 10 to 34 inches thick. The upper part is olive brown, light yellowish brown, or pale olive, and the lower part ranges to pale-yellow or olive-yellow clay or silty clay. Grayish and yellowish mottles and specks are common.

The C horizon ranges from olive or yellow to light gray. It is clay, clayey shale, shaly clay, or shale. Layers of weakly cemented sandstone and gypsum crystals are common. The accumulation of calcium carbonate ranges from films and threads that are barely visible to about 5 percent soft powdery masses or lumps and concretions.

KcF—Kincheloe soils, 10 to 30 percent slopes. These strongly sloping to steep clays are on distinct escarpments, hillsides, and valley walls next to upland plains. They are in long, narrow areas of 30 to 250 acres. Geological erosion is still active.

This mapping unit is about 67 percent Kincheloe soils and similar soils that are 15 to 35 percent gravel. The remaining 33 percent consists mainly of eroded soils that are less than 20 inches deep to unweathered shale. The pattern of soils in areas of this mapping unit is not uniform.

Included with these soils in mapping are small spots of Monteola soils and a few narrow areas of Olmos soils, generally on ridges. Also included are gullies, stream channels, and scoured areas that have no vegetation.

Because surface runoff is rapid and permeability is very slow, the hazard of erosion is high. Sheet and gully erosion is severe in many areas. Gullies as much as 6 feet deep and 5 to 30 feet wide at intervals of 100 to 500 feet are common. The soils tend to seal over during periods of heavy rainfall. The lack of moisture is a limitation to the use of this soil for dryfarmed forage grasses.

Thorny brush has invaded many areas of these soils. The main management needs are brush control and establishment of an adequate cover of perennial vegetation. Grazing must be regulated. Some drainageways can be converted to grassed waterways. Fencing and water development are also needed. There are suitable sites for farm ponds and wildlife areas. Capability unit VIe-1, dryland; not in a pasture and hayland group; Shallow, Rio Grande Plain, range site.

Knippa Series

The Knippa series consists of deep, well-drained, nearly level or gently sloping soils on outwash plains and old stream terraces above overflow. These soils formed in calcareous clayey material washed from limestone on uplands.

In a representative profile the surface layer is clay about 14 inches thick. It is brown in the upper part and dark brown below. The next layer is reddish-brown clay 12 inches thick. The 8 inches below this is brown clay and about 5 percent calcium carbonate concretions. Below this is light-brown clay loam about 16 inches thick. The underlying material, to a depth of 80 inches, is reddish-yellow clay loam and about 15 percent visible calcium carbonates in soft masses and cemented concretions.

Permeability is moderately slow, and the available water capacity is high.

Knippa soils are used mainly for crops, but a few areas remain in native range. These soils are well suited to irrigation. The principal dryfarmed crops are grain sorghum, small grains, and forage crops. Under irrigation the same crops and corn (fig. 7), vegetables, and other truck crops are grown.

Representative profile of Knippa clay, 0 to 1 percent slopes, in an idle field, 3.5 miles northwest on Farm Road 462 from its junction with U.S. Highway 90 in Hondo, 0.1 mile west on county road, and 100 feet south:

Ap—0 to 8 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) when moist; weak, fine and medium, subangular blocky and granular structure; hard, firm but crumbly; many fine roots; few fine calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—8 to 14 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) when moist; moderate, fine and medium, subangular blocky structure; very hard, very firm; many fine roots; few fine pores and old insect tunnels; few shiny pressure faces on peds; few fine calcium carbonate concretions; few dark streaks along old root channels; calcareous; moderately alkaline; clear, wavy boundary.

B2—14 to 26 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; moderate, fine and very fine, angular blocky structure; extremely hard, very firm; few fine roots and pores; shiny pressure faces on peds; few fine calcium carbonate concretions; dark stains on some peds and along old root channels; calcareous; moderately alkaline; gradual, wavy boundary.

Figure 7.—Harvesting corn in an irrigated field on Knippa clay, 0 to 1 percent slopes.

B22ca—26 to 34 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) when moist; moderate, fine, angular blocky structure; extremely hard, very firm; very few roots; few fine pores and old root channels; about 5 percent, by volume, is fine calcium carbonate concretions; few dark stains on some peds and along old root channels; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—34 to 50 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; massive; very hard, friable; about 25 percent, by volume, is soft masses and cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—50 to 80 inches, reddish-yellow (7.5YR 7/6) clay loam, light brown (7.5YR 6/4) when moist; massive; hard, friable; about 15 percent, by volume, is soft masses and cemented concretions of calcium carbonate; calcareous; moderately alkaline.

A few rounded chert or limestone pebbles are scattered throughout the solum, and in some places there are layers of gravel between depths of 4 and 15 feet.

The A horizon is 9 to 30 inches thick. It is dark brown, brown, dark grayish brown, or reddish brown.

The B horizon is 10 to 26 inches thick. It is brown, reddish-brown, dark-brown, or yellowish-red clay or silty clay. The content of visible calcium carbonate ranges from a few segregated films and threads in the upper part to as much as 5 percent fine concretions in the lower part.

The upper part of the Cca horizon contains 15 to 40 percent, by volume, weakly to strongly cemented calcium carbonate concretions as large as ½ inch, and the lower part contains 5 to 15 percent. This horizon is light brown, light yellowish brown, reddish yellow, or pink and is clay, clay loam, or silty clay loam.

KnA—Knippa clay, 0 to 1 percent slopes. This nearly level soil is mainly on broad, smooth outwash plains and old stream terraces. It is mainly in rounded to irregularly shaped areas of 30 to 2,000 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small spots of Castroville, Mercedes, and Victoria soils in slight depressions. Also included are patches of Olmos, Valco, and Sabenyo soils on slightly higher knolls.

Surface runoff is slow, and the hazard of erosion is slight.

Management needs on both dryfarmed and irrigated fields include using fertilized crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIs-1, dryland, and IIs-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

KnB—Knippa clay, 1 to 3 percent slopes. This gently sloping soil is mainly on breaks between soils on higher and lower positions. It is typically in long, narrow areas that range from 8 to 100 acres.

The surface layer is brown clay about 12 inches thick. The next layer, which is 14 inches thick, is brown clay and a few calcium carbonate concretions. Beneath this is light-brown clay that extends to a depth of 50 inches. It contains about 15 percent, by volume, visible concretions of calcium carbon-ate in the upper part and about 7 percent below that.

Included with this soil in mapping are small spots of Castroville, Mercedes, Sabenyo, and Valco soils.

Surface runoff is medium, and the hazard of erosion is moderate. Where the soil is unprotected, small rills and gullies form after heavy rains.

Among management needs for cultivated fields are fertilization, use of crops that help protect the soil during the growing season and that furnish sufficient residue to conserve moisture, maintenance of tilth and productivity, and protection and improvement of the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. In some places grassed waterways are needed to safely dispose of excess runoff and help control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and other improved pasture grasses. Among management needs for pasture are fertilization, weed control, grazing control, and rotation grazing. Proper timing and methods of harvesting hay are important. Capability units IIIe-2, dryland, and IIe-4, irrigated; pasture and hayland group 7C; Clay Loam range site.

Lacoste Series

The Lacoste series consists of shallow, well-drained, gently sloping soils on uplands. These soils formed in loamy sediment over thick beds of caliche.

In a representative profile the surface layer is dark-brown fine sandy loam about 9 inches thick. The next layer is yellowish-red sandy clay loam about 8 inches thick. This layer rests abruptly on a layer of pinkish-white, strongly cemented caliche about 2 inches thick. The underlying material, to a depth of 68 inches, is white, weakly cemented caliche.

Permeability is moderate, and the available water capacity is low.

Lacoste soils are used mainly for range and wildlife habitat. Only a few small areas are cultivated. The principal crops are grain sorghum, small grains, and forage crops. A small acreage is irrigated, and in a few areas caliche is mined for road material.

Representative profile of Lacoste fine sandy loam, in an area of Lacoste soils, 1 to 5 percent slopes, in an old field near a caliche pit, 13.8 miles south of Hondo on Farm Road 462, then east on county road for 0.1 mile, and 100 feet south of the county road:

A1—0 to 9 inches, dark-brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) when moist; weak, fine and medium, subangular blocky and granular structure; very hard, very friable; many fine roots and pores; few rounded chert pebbles; few angular caliche fragments; neutral; abrupt, smooth boundary.

B2t—9 to 17 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; very hard, friable; common roots; many fine pores; many worm and insect tunnels; few clay bridges and films in pores and root channels; neutral; abrupt, wavy boundary.

C1cam—17 to 19 inches, pinkish-white (7.5YR 8/2) strongly cemented caliche; somewhat platy and fractured and laminar in upper part; calcareous; moderately alkaline; clear, wavy boundary.

C2ca—19 to 68 inches, white (10YR 8/2) weakly cemented caliche; few pockets of very pale brown loam; calcareous; moderately alkaline.

The solum is 10 to 20 inches thick. It is neutral to moderately alkaline but is noncalcareous.

The A horizon is 4 to 11 inches thick. It is brown, reddish-brown, or strong-brown fine sandy loam or loamy fine sand. It contains as much as 5 percent angular limestone or caliche fragments and as much as 15 percent rounded chert gravel.

The Bt horizon is 5 to 10 inches thick. It ranges from yellowish-red to red fine sandy loam or sandy clay loam. It is as much as 15 percent coarse fragments.

The C1cam horizon is 1 to 6 inches thick. It is strongly cemented or indurated caliche. The upper part is laminar in most places.

LaC—Lacoste soils, 1 to 5 percent slopes. These gently sloping soils are on low ridges of upland divides. They are in rounded to irregularly shaped areas of 10 to 75 acres.

Lacoste fine sandy loam is dominant, but Lacoste loamy fine sand and soils that are calcareous and less than 20 inches deep to weakly indurated caliche are also in this mapping unit. The pattern of soils in areas of this mapping unit is not uniform.

Included with these soils in mapping are small areas of Duval and Webb soils in slight depressions along drainageways and spots of Olmos and Yologo soils on low knolls or ridges.

Nearly all areas of these soils are used for range. Surface runoff is medium, and the hazard of erosion is moderate. Crop response is limited by the lack of soil depth.

These soils are best suited to native or introduced grasses. They are easily tilled. The main management needs are to conserve moisture, control soil blowing and water erosion, and maintain a good cover of vegetation. The cropping system should provide a large amount of plant residue, and the residue should be left on or near the soil surface. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, and blue panicum. Grazing and mowing should be regulated, and brush control, cross fencing, and water development are needed in some places. Capability units IVe-2, dryland, and IIIe-5, irrigated; pasture and hayland group 14A; Shallow Sandy Loam range site.

Mercedes Series

The Mercedes series consists of deep, moderately well drained, nearly level to gently sloping soils on outwash plains and stream terraces above overflow. These soils formed in calcareous, clayey alluvium or marine sediment several feet thick.

In a representative profile the surface layer is gray clay about 31 inches thick. Below this is light brownish-gray clay 23 inches thick. The underlying material, to a depth of 66 inches, is very pale brown clay and common soft masses and concretions of calcium carbonate.

Permeability is very slow, and the available water capacity is high. These soils crack when dry. Water intake is rapid when the soils are dry and the cracks are open, but it is very slow when the soils are moist and the cracks close. The soils shrink and swell with changes in moisture content, and this causes churning or mulching within the soil profile.

Mercedes soils are used mainly for crops. The main dryfarmed crops are grain sorghum, small grain, forage crops, and some cotton. Under irrigation, these crops and corn and a few vegetables and truck crops are grown.

Representative profile of Mercedes clay, 0 to 1 percent slopes, in a cultivated field, 13.7 miles west of Hondo on U.S. Highway 90 and 100 feet north:

Ap—0 to 7 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; weak, fine, subangular blocky and moderate, medium, granular structure; hard, firm but crumbly, sticky and plastic; many roots; few rounded chert pebbles scattered on surface; few, fine, cemented calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—7 to 17 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; moderate, fine and medium, irregular blocky structure; very hard, very firm, very sticky and plastic; common roots; few pores; shiny clay films on peds; few, fine, cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

A12—17 to 31 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; moderate parallelepiped structure; common intersecting slickensides; very hard, very firm, very sticky and plastic; few roots, mainly between peds; common, fine, cemented calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

AC—31 to 54 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) when moist; distinct parallelepiped structure; coarse, grooved, intersecting slickensides; few gray streaks along old filled cracks; extremely hard, extremely firm, very sticky and plastic; common, fine, cemented calcium carbonate concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

C—54 to 66 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) when moist; massive; very hard, very firm, very sticky and plastic; common soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The thickness of the solum and the depth to the C horizon range from 42 to 72 inches. The combined thickness of the A and AC horizons varies within short distances because of the cyclic nature of the soils. The solum is thinner on the microridges than in the microdepressions. Siliceous pebbles make up 1 to 10 percent, by volume, of any horizon. When dry, these soils have cracks that extend from the surface to the C horizon.

The A horizon is 18 to 36 inches thick. It is gray or light gray. The amplitude of waviness in the boundary between the A and AC horizons is about 4 to 12 inches.

The AC horizon is 26 to 46 inches thick. It is grayish brown, light brownish gray, or pale brown.

The C horizon ranges from brown to very pale brown. Accumulations of gypsum and other salts, as well as calcium carbonate in the form of lumps and soft masses and concretions, range from few to many.

McA—Mercedes clay, 0 to 1 percent slopes. This nearly level soil is in broad, rounded to irregularly shaped areas that range from 10 to several hundred acres. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Knippa and Monteola soils, mainly on slope breaks next to soils at a higher position. Victoria soils are included in long, narrow, shallow depressions along natural drainageways. Also included are a few spots of a similar soil that has a darker colored surface layer and areas of a soil that is noncalcareous in the surface layer.

Surface runoff is slow, and the hazard of erosion is slight.

Management needs for both dryfarmed and irrigated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land. Fertilization, minimum tillage, crop rotation, and proper use of plant residue help to conserve moisture and maintain tilth and productivity. Insects, weeds, and crop diseases need to be controlled.

Suitable pasture and hay plants are improved bermudagrass, Gordo bluestem, Kleberg bluestem, kleingrass, and other grasses. Among management needs for pasture are fertilization, weed control, grazing control, and rotation grazing. Because hoofpans and surface crusts form, water intake is decreased in many places on pasture and range. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIs-2, dryland, and IIs-4, irrigated; pasture and hayland group 7A; Clay Flat range site.

McB—Mercedes clay, 1 to 3 percent slopes. This gently sloping soil is mainly on slope breaks between more level Mercedes soils and soils on higher or lower positions. It is also along narrow drainageways. It is usually in long and rather narrow areas that range from 8 to 250 acres.

The surface layer is gray clay 28 inches thick. The layer below that, which is 16 inches thick, is light brownish-gray clay and common fine calcium carbonate concretions. The underlying material, to a depth of 60 inches, is very pale brown clay and common soft lumps and concretions of calcium carbonate.

Included with this soil in mapping are patches of Knippa and Monteola soils on the outer fringes of areas of Mercedes soils. Also included is a similar soil that is noncalcareous in the surface layer.

Surface runoff is medium, and the hazard of erosion is moderate. Where the soil is unprotected, small rills and gullies form after heavy rains but are usually eliminated by normal tillage.

Management needs for cultivated fields include fertilization and using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion. In some places grassed waterways are needed to safely dispose of excess water and help control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-6, dryland, and IIIe-6, irrigated; pasture and hayland group 7A; Clay Flat range site.

Mereta Series

The Mereta series consists of shallow, well-drained, gently sloping soils on uplands. These soils formed in thick beds of weakly cemented limestone or in caliche that is strongly cemented in the upper few inches.

In a representative profile the surface layer is clay 17 inches thick. It is dark grayish brown in the upper 8 inches and brown below. It is abruptly over a layer of pinkish-white, indurated caliche that is 2 inches thick and that has about 5 percent soil in cracks and crevices. Beneath this, to a depth of 24 inches, is pink, weakly cemented, caliche or limestone of about loam texture.

Permeability is very slow in the indurated caliche layer. The available water capacity is low because the soils are so shallow.

These soils are used mainly for range (fig. 8), but a few areas are cultivated. The principal crops are small grain and forage crops.

Figure 8.—Native range that has been cleared of brush, on Mereta clay, 1 to 3 percent slopes.

Representative profile of Mereta clay, 1 to 3 percent slopes, in range, 1.5 miles west of D'Hanis on U.S. Highway 90, 3.6 miles northwest on blacktop road, 4.3 miles north and 0.5 mile west on county road, and 175 feet north:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; moderate, fine, sub-angular blocky and medium granular structure; hard, friable; many fine roots; common pores and insect tunnels; few fine and very fine limestone fragments; calcareous; moderately alkaline; clear, smooth boundary.

A12—8 to 17 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) when moist; moderate, fine and very fine, subangular blocky structure; very hard, firm but crumbly; many fine roots; few pores and old root channels; common fine and very fine limestone fragments or concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

C1cam—17 to 19 inches, pinkish-white (7.5YR 8/2) indurated caliche; fractured and platy; about 5 percent clay from the A12 horizon in cracks and fractures; calcareous; moderately alkaline; clear, wavy boundary.

C2ca—19 to 24 inches, pink (7.5YR 8/4) weakly cemented caliche or soft limestone of about loam texture; slightly hardened and platy in upper 1 inch.

In most places there are no coarse fragments but some profiles contain as much as 10 percent, by volume, hard, angular caliche.

The thickness of the A horizon and the depth to a layer of strongly cemented or indurated caliche range from 14 to 20 inches. The upper part of the A horizon ranges from brown to dark grayish brown, and the lower part is reddish brown or dark reddish brown.

The C1cam horizon is 3 to 8 inches thick. It ranges from strongly cemented to indurated caliche that is massive to platy. The C2ca horizon consists of soft caliche of loam or clay loam that is very high in calcium carbonate.

MeB—Mereta clay, 1 to 3 percent slopes. This gently sloping soil is in oblong or irregularly shaped areas of 15 to 200 acres.

Included with this soil in mapping are small areas of Pratley soils in slight depressions along drainageways. Also included are small spots of Brackett, Doss, Kavett, and Speck soils in slightly higher areas.

Surface runoff is medium, and the hazard of erosion is moderate. This soil is easily tilled, but depth of tillage and crop response are limited by the shallowness of the soil. Chlorosis occurs in some plants on this soil.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. Grassed waterways help to carry off excess water and control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, side-oats grama, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-3, dryland, and IIIe-2, irrigated; pasture and hayland group 13A; Shallow, Edwards Plateau range site.

Miguel Series

The Miguel series consists of deep, well-drained, nearly level to gently sloping soils on terraces and uplands. These soils formed from clayey and loamy sediment.

In a representative profile the surface layer is brown fine sandy loam about 10 inches thick. The next layer is 49 inches thick. In the upper 25 inches it is yellowish-brown and brown clay that has red, reddish-brown, and reddish-yellow mottles. In the next 11 inches it is reddish-yellow sandy clay that has reddish-brown and reddish-yellow mottles. In the lower 13 inches it is reddish-yellow sandy clay loam and about 10 percent soft masses and concretions of calcium carbonate. Below this, to a depth of 90 inches, is yellow sandy clay loam and a few soft masses and concretions of calcium carbonate.

Permeability is very slow, and the available water capacity is high.

Miguel soils are used mostly for range, but some areas are used for grain sorghum, corn, oats, and improved pasture. A few areas are irrigated.

Representative profile of Miguel fine sandy loam, 0 to 1 percent slopes, in an idle field, 10.9 miles southeast on State Highway 173 from its junction with U.S. Highway 90 in Hondo, 3.1 miles south and 1 mile east on county road, then 100 feet south:

Ap—0 to 10 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky and granular structure; hard, friable; common fine roots; few earthworm and insect tunnels; neutral; abrupt, smooth boundary.

B21t—10 to 18 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) when moist; many, medium, distinct, red and reddish-brown mottles; moderate, medium, prismatic structure parting to moderate, medium, angular blocky; extremely hard, very firm; common fine roots; common pores and old insect and earthworm tunnels; distinct clay films on surfaces of peds; neutral; clear, wavy boundary.

B22t—18 to 35 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) when moist; common, medium, faint, reddish-brown and reddish-yellow mottles; weak, medium, prismatic structure parting to moderate, medium, angular blocky; extremely hard, very firm; few fine roots, mainly between peds; distinct clay films on peds; few dark stains on surfaces of peds; neutral; gradual, wavy boundary.

B3t—35 to 46 inches, reddish-yellow (7.5YR 6/6) sandy clay, strong brown (7.5YR 5/6) when moist; common, medium, distinct, reddish-brown and reddish-yellow mottles; weak, fine and medium, blocky structure; very hard, very firm; few fine roots and pores; few patchy clay films on peds; few fine calcium carbonate concretions; matrix is noncalcareous; moderately alkaline; clear, wavy boundary.

B3ca—46 to 59 inches, reddish-yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) when moist; weak, medium and fine, subangular blocky structure; very hard, firm; about 10 percent, by volume, is soft masses and weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—59 to 90 inches, yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) when moist; streaks and splotches of light-gray (10YR 7/2) material; massive; hard, friable; few soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The A horizon is generally 6 to 12 inches thick, but where the soils receive overwash, it is as much as 18 inches thick. This horizon is grayish-brown, dark grayish-brown, brown, dark yellowish-brown, or reddish-brown fine sandy loam or loamy fine sand. It is slightly acid or neutral.

The B2t horizon is 6 to 35 inches thick. It is dark brown, brown, yellowish brown, brownish yellow, light brown, dark grayish brown, or yellowish red and is sandy clay or clay. This horizon has common to many mottles in shades of brown, red, or yellow. It is neutral or mildly alkaline.

The B3t horizon, 4 to 20 inches thick, is light-brown, light yellowish brown, yellowish-red, brown, or reddish-yellow sandy clay loam or sandy clay. This horizon is mildly alkaline or moderately alkaline. The B3ca and C horizons are yellow, light brownish gray, light gray, light brown, yellowish red, reddish yellow, or brownish yellow. The B3ca horizon is calcareous and moderately alkaline. It is 3 to 15 percent, by volume, soft lumps and masses of calcium carbonate. The C horizon is at a depth of 40 to 60 inches. It is sandy clay loam or sandy clay.

MgA—Miguel fine sandy loam, 0 to 1 percent slopes. This nearly level soil is mainly adjacent to upland drainageways: It is in irregularly shaped areas of 9 to 175 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are soils that are similar to Miguel soils but have a darker surface layer and a darker, loamy subsoil. Also included are small areas of Duval and Webb soils.

Surface runoff is slow, and the hazard of erosion is slight.

Management needs on both dryfarmed and irrigated fields include using crops that help protect the soil from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing

seasons. A well-designed irrigation system and proper water management are needed on irrigated land. Fertilization, minimum tillage, crop rotation, and proper use of plant residue help to conserve moisture and maintain tilth and productivity. Insects, weeds, and crop disease need to be controlled.

Suitable pasture and hay plants are improved bermudagrass, kleingrass, blue panicum, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIs-2, dryland, and IIs-3, irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

MgB—Miguel fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is typically adjacent to upland drainageways on breaks next to soils on a higher position. It is in irregularly shaped areas of 10 to 200 acres.

The surface layer is fine sandy loam about 12 inches thick. It is grayish brown in the upper 4 inches and dark grayish brown below that. The next layer extends to a depth of 42 inches. In the upper 7 inches it is brown sandy clay that has a few reddish-brown mottles. In the next 17 inches it is yellowish-brown sandy clay that has common yellow and strong-brown mottles. In the lower 6 inches it is light-brown sandy clay loam and about 3 percent, by volume, concretions of calcium carbonate. Below that is reddish-yellow sandy clay loam.

Included with this soil in mapping are small areas of Amphion, Duval, and Webb soils. Also included is a soil that is similar to Miguel soils but has a darker surface layer and is less clayey below the surface layer.

Surface runoff is medium. The hazards of soil blowing and water erosion are moderate.

Management needs for cultivated fields include using crops that help protect the soil from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. In some places grassed waterways are needed to safely dispose of excess runoff and help control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, kleingrass, blue panicum, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-7, dryland, and IIIe-8, irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

MhA—Miguel soils, 0 to 1 percent slopes. These nearly level soils are on concave, shallow drainageways in the uplands. They are in elongated areas of 10 to 50 acres.

This mapping unit is 50 percent Miguel fine sandy loam and soils that are very similar to Miguel fine sandy loam but have a thicker surface layer because they receive overwash. A similar soil that has a thicker, darker colored surface layer and is less clayey below the surface layer makes up 26 percent of the mapping unit, and Amphion soils make up 13 percent. The remaining 11 percent consists of Duval, Hanis, and Webb soils. The pattern of soils in areas of this mapping unit is not uniform.

The surface layer is brown fine sandy loam about 18 inches thick. The next layer is about 40 inches thick. In the upper part it is yellowish-brown sandy clay that has many mottles in shades of yellow, brown, and red. In the lower part it is brown sandy clay that has few to common mottles. Below that, to a depth of 72 inches, is mottled, reddish-yellow sandy clay loam and about 5 percent soft lumps and concretions of calcium carbonate.

Surface runoff is slow. Runoff from surrounding soils tends to collect on these soils. Where the water collects, there is some erosion and reworking of soil material. The hazard of soil blowing is moderate. Many areas of this soil are idle or are used for range, but most areas are cultivated.

Management needs for cultivated fields include using crops that help protect the soil from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land. Fertilization, minimum tillage, crop rotation, and proper use of plant residue help to conserve moisture and maintain tilth and productivity. Insects, weeds, and crop diseases need to be controlled. In some places grassed waterways are needed along narrow drainageways to help control erosion and safely dispose of excess water.

Suitable pasture and hay plants are improved bermudagrass, weeping lovegrass, kleingrass, blue panicum, buffelgrass, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIe-3, dryland, and I-5, irrigated; pasture and hayland group 8A; Sandy Loam range site.

Monteola Series

The Monteola series consists of deep, moderately well drained, gently sloping soils on uplands. These soils formed in clay and shaly clay many feet thick.

In a representative profile the surface layer is very dark gray, calcareous clay about 26 inches thick. The next layer is dark grayish-brown and grayish-brown, calcareous clay about 18 inches thick. The underlying material, to a depth of 56 inches, is pale-brown clay. Below this is light yellowish-brown clay or shaly clay to a depth of 75 inches.

Permeability is very slow, and the available water capacity is high. These soils crack when dry and swell when wet. Water enters the soils readily when the cracks are open, but it enters very slowly when the soils are moist and the cracks are closed.

Monteola soils are used for crops and range. The principal dryfarmed and irrigated crops are corn, grain sorghum, and small grain. A few areas are planted to improved bermudagrass and other introduced pasture grasses.

Representative profile of Monteola clay, 1 to 5 percent slopes, at the edge of a cultivated field, 5.3 miles south on Farm Road 1343 from its junction with U.S. Highway 90 in Castroville, 3.1 miles east on county road and 400 feet south:

Ap—0 to 5 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; moderate, fine and medium, subangular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; few scattered limestone and chert pebbles; few fine and very fine calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—5 to 26 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; common. parallelepipeds with few intersecting slickensides parting to moderate, fine, blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few limestone pebbles; few fine and very fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

AC1—26 to 36 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) when moist; common parallelepipeds with intersecting slickensides parting to moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and plastic; common very dark gray (10YR 3/1) streaks along old closed cracks; few fine roots; few fine and very fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

AC2—36 to 44 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; common parallelepipeds with intersecting slickensides parting to weak, medium, blocky structure; extremely hard, very firm, very sticky and plastic; few very dark gray (10YR 3/1) streaks along old closed cracks; few fine roots, mainly between peds; common fine and very fine soft masses and concretions of calcium carbonate, increasing in lower part; calcareous; moderately alkaline; clear, wavy boundary.

C1—44 to 56 inches, pale-brown (10YR 6/3) clay, brown (10YR 5/3) when moist; massive; extremely hard, very firm, very sticky and plastic; few dark streaks; few black-brown concretions; few, soft, fine masses and concretions of calcium carbonate; few accumulations of gypsum crystals and other salts; calcareous; moderately alkaline.

C2—56 to 75 inches, light yellowish-brown (10YR 6/4) clay or shaly clay, yellowish brown (10YR 5/4) when moist; few olive-brown mottles; massive; extremely hard, very firm, very sticky and plastic; few weakly cemented calcium carbonate concretions; common seams and accumulations of gypsum crystals and other salts; calcareous; moderately alkaline.

The thickness of the solum and the depth to calcareous shaly clay or marl range from 40 to 60 inches. The combined thickness of the A and AC horizons varies within short distances because of the shrinking and swelling of the clay. Areas that have never been plowed have Gilgai relief, which consists of microknolls or ridges and microdepressions or valleys. The solum is thinner on the microridges than in the microdepressions.

The A horizon is 14 to 30 inches thick. It is dominantly clay but ranges to gravelly clay. It is dark gray or very dark gray. Rounded siliceous pebbles and cobbles make up as much as 10 percent, by volume, of the A horizon in nongravelly areas of Monteola soils. In gravelly areas they make up as much as 25 percent, by volume, of the upper 10 inches.

The AC horizon is 12 to 39 inches thick. The clay content ranges from 50 to 60 percent. This horizon is grayish brown, dark grayish brown, pale brown, brown, light brownish gray, or light olive brown. Gray, dark-gray, or very dark gray streaks are from few to common along old closed cracks.

The C horizon consists of many feet of clay or shaly clay. It is light gray, very pale brown, pale yellow, pale brown, pale olive, white, or light brownish gray and contains few to common, weakly to strongly cemented concentrations of calcium carbonate and gypsum salts.

MnC—Monteola clay, 1 to 5 percent slopes. This gently sloping soil is on slope breaks of erosional uplands. It is in rounded to irregularly shaped areas that range from 10 to 250 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are Mercedes and Victoria soils, mainly in long, narrow areas along drainage-ways. Monteola gravelly clay and Quihi soils are included on low, rounded knolls.

This soil is used for range and crops. Surface runoff is medium, and the hazard of erosion is medium.

Management needs on both dryfarmed and irrigated fields included using crops that help protect the soil during their growth and that furnish sufficient residue to conserve moisture, maintain tilth and productivity, and protect and improve the soil during the growing season. Terraces and contour tillage help to control erosion. In some places grassed waterways are needed to safely dispose of excess runoff and control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, Gordo bluestem, Kleberg bluestem, kleingrass, blue panicum, and other introduced pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-6, dryland, and IIIe-6, irrigated; pasture and hayland group 7A; Rolling Blackland range site.

MoC—Monteola gravelly clay, 1 to 5 percent slopes. This gently sloping soil is mainly on uplands that have smooth or undulating relief. It is in oval to oblong areas that range from 10 to 300 acres.

The surface layer is very dark gray gravelly clay about 26 inches thick. It is about 20 percent chert gravel in the upper 10 inches and about 10 percent below. The next layer is dark grayish-brown and grayish-brown clay that contains a few chert pebbles and common concretions of calcium carbon-ate. The underlying material, to a depth of 62 inches, is very pale brown clay that contains common weakly and strongly cemented concretions of calcium carbonate and a few gypsum crystals.

Included with this soil in mapping are small areas of Monteola clay and a similar soil that is noncalcareous in the upper few inches. Also included are Quihi soils on small, rounded or oval knolls.

Most areas of this soil are used for range, but some are cultivated. Surface runoff is medium, and the hazard of erosion is slight. The pebbles on the surface help to reduce water erosion and evaporation.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to conserve moisture, maintain tilth and productivity, and protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion. In some places grassed waterways are needed to safely dispose of excess runoff and control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, Gordo bluestem, Kleberg bluestem, kleingrass, blue panicum, and other introduced pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-8, dryland, and IIIe-6, irrigated; pasture and hayland group 7A; Rolling Blackland range site.

Nueces Series

The Nueces series consists of deep, moderately well drained, nearly level to gently sloping soils on uplands. These soils formed in eolian sand and sandy clay loam.

In a representative profile the surface layer is fine sand about 34 inches thick. In the upper 14 inches it is pale brown. In the next 16 inches it is yellowish brown. In the lower 4 inches it is light yellowish brown. The next layer is 50 inches thick. In the upper 8 inches it is light brownish-gray sandy clay loam that has reddish-yellow mottles. In the next 11 inches it is mottled, very pale brown sandy clay loam. In the lower 31 inches it is mottled, brownish-yellow sandy clay loam. Very pale brown sandy clay loam is below a depth of 84 inches.

Permeability is moderately slow, and the available water capacity is low.

Nueces soils are used mainly for range. A few areas are in dryfarmed and irrigated peanuts and watermelons.

Representative profile of Nueces fine sand, in an area of Nueces soils, 0 to 5 percent slopes, in improved pasture, 4.5 miles west on Farm Road 2200 from its junction with State Highway 173 in Devine and 200 feet north:

A11—0 to 14 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 4/3) when moist; single grained; loose, very friable; slightly acid; gradual, smooth boundary.
A12—14 to 30 inches, yellowish-brown (10YR 5/4) fine sand, dark yellowish brown (10YR 4/4) when moist; single grained; loose, very friable; slightly acid; gradual, smooth boundary.
A13—30 to 34 inches, light yellowish-brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) when moist; single grained; slightly hard, very friable; slightly acid; abrupt, wavy boundary.
B21t—34ato 42 inches, light brownish-gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) when moist; about 20 percent medium and coarse, distinct, reddish-yellow (7.5YR 6/8) mottles; moderate, coarse, prismatic structure; extremely hard, firm; common fine pores and old root channels; few, thin, patchy clay films on peds and in pores; few dark stains on peds; neutral; gradual, smooth boundary.
B22t—42 to 53 inches, very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) when moist; about 40 percent coarse and medium, prominent, reddish-yellow (7.5YR 6/8) mottles and few, fine, dark-red (2.5YR 3/6) mottles; few roots and fine pores; few dark stains on surfaces of peds; few clay films; neutral; gradual, smooth boundary.
B3t—53 to 84 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) when moist; few, faint, yellowish-brown mottles and dark stains; moderate, fine and medium, blocky structure; very hard, friable; few pores; few old root channels partly filled with darker material; noncalcareous; mildly alkaline; gradual, wavy boundary.
C—84 to 94 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) when moist; common, distinct, splotches and streaks of reddish yellow (7.5YR 7/8) and very pale brown (10YR 8/3); massive; very hard, friable; noncalcareous; moderately alkaline.

The A horizon is 20 to 39 inches thick. It is brown, yellowish brown, pale brown, grayish brown, or light yellowish brown and is fine sand or loamy fine sand. Reaction is slightly acid or neutral.

The B2t horizon is 13 to 25 inches thick. It is brown, grayish brown, light brownish gray, very pale brown, brownish yellow, or yellow and is fine sandy loam or sandy clay loam. It has common mottles in shades of red, brown, yellow, or gray. Reaction is neutral to moderately alkaline.

The B3t and C horizons are mainly sandy clay loam or fine sandy loam. They are typically moderately alkaline but range to neutral. The C horizon is interbedded with weakly consolidated sandstone or shale in some places.

NuC—Nueces soils, 0 to 5 percent slopes. These nearly level to gently sloping, sandy soils are in large, irregularly shaped areas of 50 to several hundred acres.

This mapping unit is about 62 percent Nueces fine sand and about 19 percent Poth and Wilco soils. The remaining 19 percent consists of a soil that is similar to Nueces soils but has a surface layer more than 40 inches thick and is slightly more acid below the surface layer. The pattern of soils in areas of this mapping unit is not uniform.

Water enters the soil rapidly, but the movement of water into the lower layers is moderately slow. Surface runoff is very slow. The hazard of soil blowing is moderate.

Management needs for cultivated fields include using crops that help protect the soil from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Management of plant residue and frequent light applications of fertilizer help to conserve moisture

and maintain tilth and productivity. A well-designed irrigation system and proper water management are needed on irrigated land. Sprinkler irrigation systems are best suited to this soil.

Suitable pasture and hay plants are improved bermudagrass, weeping lovegrass, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. The chief management need for range is the prevention of soil blowing. Capability units IIIe-5, dryland, and IIIs-1, irrigated; pasture and hayland group 9A; Deep Sand range site.

Olmos Series

The Olmos series consists of very shallow to shallow, well-drained, gently sloping to sloping and undulating soils on uplands. These soils formed in outwash materials from limestone areas.

In a representative profile the upper 5 inches of the surface layer is dark grayish-brown gravelly clay loam and about 55 percent indurated caliche fragments. The lower 9 inches is dark grayish-brown very gravelly clay loam and about 75 percent platy caliche fragments. Beneath that and extending to a depth of 66 inches is white, weakly cemented caliche. The upper 1 inch of this layer is strongly cemented and laminar.

Permeability is moderate in the upper part of the soils and slow in the hardened caliche layer. The available water capacity is very low because of the shallowness of the soil and the amount of coarse fragments (fig. 9).

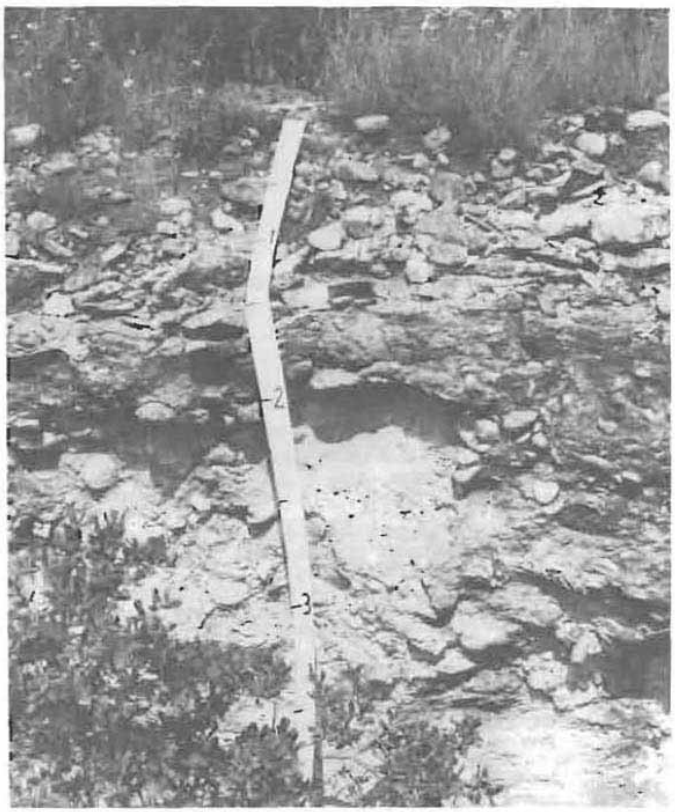

Figure 9.—Profile of Olmos gravelly clay loam. Hardened caliche is at a depth of about 1 to 1½ feet.

Olmos soils are used for range or wildlife habitat. Roadbed materials have been mined from open pits in some areas of these soils.

Representative profile of Olmos gravelly clay loam, in an area of Olmos association, undulating, in native pasture, 15.4 miles west of Hondo on U.S. Highway 90 and 200 feet south:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky structure; hard, friable; surface crust of 1/8 inch that is light brownish gray (10YR 6/2) when dry; 20 percent is indurated caliche pebbles 1/8 to 1 ½ inch in size; about 35 percent, by volume, is indurated caliche cobbles; many caliche fragments smaller than 1 millimeter; many fine roots; calcareous; moderately alkaline; clear, smooth boundary.

A12—5 to 14 inches, dark grayish-brown (10YR 4/2) very gravelly clay loam in the interstices between platy fragments of indurated caliche, very dark grayish brown (10YR 3/2) when moist; about 75 percent, by volume, is caliche fragments; about 35 percent of the caliche fragments are larger than 3 inches; many fine roots in the interstices; calcareous; moderately alkaline; abrupt, wavy and irregular boundary.

C1cam—14 to 15 inches, white (10YR 8/2) strongly cemented caliche that has a hardness of more than 3 on Mohs scale.

C2ca—15 to 66 inches, white (10YR 8/2) weakly cemented caliche, pinkish white (7.5YR 8/2) when moist; few chert pebbles.

The thickness of the solum and the depth to a layer of cemented caliche range from 7 to 20 inches within short distances. The surface cover of coarse fragments ranges from 5 to 75 percent within short distances. The coarse fragments in the solum are mainly weakly cemented or indurated caliche, but limestone and chert fragments are also present. Many fragments are laminar in the upper part and slightly knobby in the lower part.

The A horizon is dark brown, very dark grayish brown, grayish brown, dark grayish brown, or brown and ranges from loam to clay loam. Clay content ranges from 22 to 35 percent, and coarse fragments make up 35 to 75 percent, by volume.

The C horizon consists of beds of caliche that are indurated and laminar in the upper ¼ to 5 inches and weakly cemented below that. Rounded chert and limestone pebbles range from a few to 75 percent, by volume, of the Cca horizon.

OND—Olmos association, undulating. This association is on low knolls or long, narrow ridges. It is in oblong or irregularly shaped areas of 10 acres to several hundred acres. Slopes range from 1 to 8 percent. The Olmos gravelly clay loam in this association has the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 68 percent Olmos soils and a similar soil that is underlain by soft caliche. The remaining 32 percent is spots of Hindes, Lacoste, Rehm, Valco, and Yologo soils and long, narrow bands of Amphion and Mercedes soils in natural drainageways. Also in the association are open pits where caliche has been mined for road material. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium, and many areas are eroding especially where the soils are bare. The hazard of erosion is severe, although the coarse fragments reduce erosion to some extent by increasing water intake and limiting evaporation.

These soils are droughty and tend to seal over when they are not protected by adequate vegetation. Because of the high content of lime in these soils, some plant nutrients are not available and the quality of the forage is generally poor. The soils

are not suited to crops because they are shallow and have a high content of coarse fragments. A good cover of grass decreases surface runoff and reduces evaporation. Capability unit VIIs-2, dryland; not in a pasture and hayland group; Shallow Ridge range site.

OmD—Olmos complex, 1 to 8 percent slopes. This complex consists of gently sloping to sloping gravelly clay loams on low knolls or narrow ridges. It is in rounded or irregularly shaped areas of 6 to 25 acres. These areas are within larger areas of deeper, cultivated soils or similar soils.

This complex is 58 percent Olmos soils and similar soils and 22 percent Valco soils. The remaining 20 percent consists of Castroville, Mereta, and Yologo soils. Rock crops out in some places. Areas of these soils are so intricately mixed that it was not feasible to separate them at the scale used in mapping.

The Olmos soils in this complex have a surface layer of dark grayish-brown clay loam about 13 inches thick. This layer is about 50 percent indurated caliche fragments in the upper 4 inches and 80 percent platy caliche fragments in the lower 9 inches. The underlying material, to a depth of 60 inches, is weakly cemented caliche. The caliche is indurated and laminar in the upper few inches.

Surface runoff is medium, and the hazard of erosion is moderate.

This complex is used mostly for range. A few smaller areas are cultivated with adjoining areas of deeper soils. Capability unit VIIs-2, dryland; not in a pasture and hayland group; Shallow Ridge range site.

Orif Series

The Orif series consists of deep, well-drained, nearly level to gently sloping soils on flood plains. These soils formed in material weathered from limestone.

In a representative profile the surface layer is grayish-brown loam, about 10 inches thick, that contains a few water-rounded limestone pebbles. Below this is pale-brown, very gravelly sand, about 36 inches thick, that is stratified with about 85 percent water-rounded limestone pebbles and cobbles. The underlying material, to a depth of 84 inches, is very pale brown sand and about 2 percent gravel.

Permeability is rapid, and the available water capacity is very low. Surface runoff is very slow. Periodic major floods deposit many coarse fragments, mainly of limestone. Smaller floods of short duration deposit smaller fragments and pebbles as well as much soil material. In places there is some scouring.

Orif soils are poorly suited to cultivation. Nearly all areas are in native range and wildlife habitat. These soils are a source of sand and gravel that is used in construction.

Representative profile of Orif loam, in an area of Orif complex, in a gravel pit, 2.3 miles south of Castroville on county road along Medina River from its junction with U.S. Highway 90 and Farm Road 471, then 200 feet east of road:

A—0 to 10 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky and granular structure; slightly hard, friable; common fine roots; about 8 percent, by volume, is water-rounded limestone pebbles; calcareous; moderately alkaline; clear, smooth boundary.

IIC—10 to 46 inches, pale-brown (10YR 6/3) very gravelly sand, brown (10YR 5/3) when moist; single grained; loose, soft; few roots; about 85 percent, by volume, is water rounded lime-stone pebbles and few cobbles; few thin strata of fine sandy loam; calcareous; moderately alkaline; clear, smooth boundary.

IIIC—46 to 84 inches, very pale brown (10YR 7/4) sand, light yellowish brown (10YR 6/4) when moist; single grained; loose, soft; few roots; about 2 percent, by volume, is water-rounded limestone pebbles and cobbles; few very fine calcium carbonate concretions and visible segregated threads of calcium carbonate; calcareous; moderately alkaline.

Between depths of 10 and 40 inches, these soils contain 35 to 90 percent, by volume, water-rounded limestone pebbles less than 3 inches in diameter. There are also a few cobbles and stones in some profiles. The soils are stratified throughout with discontinuous layers, 2 to 6 inches thick, of coarse fragments and thin layers of fines. Frequent flooding in some places alters and shifts the pebbles and cobbles.

The A horizon ranges from 6 to 18 inches in thickness but is typically 8 to 12 inches thick. It is grayish brown, light brownish gray, brown, or pale brown. The fine earth fraction of the A horizon ranges from loam to loamy fine sand. Limestone pebbles range from a few to as much as 25 percent, by volume, of the A horizon, and the surface cover of pebbles or cobbles ranges from 0 to 30 percent.

The C horizon is brown, very pale brown, pale brown, light brownish gray, or light gray. The fine earth fraction of the C horizon ranges from loamy sand to sand.

Or—Orif complex. This complex consists mainly of nearly level to gently sloping loams or gravelly loams on flood plains adjacent to and about 5 to 20 feet above the stream channels. Areas are generally long and narrow and parallel to the stream channels. They range from about 20 to more than 200 acres. Slopes are 0 to 3 percent.

This complex is about 45 percent Orif soils (fig. 10), 15 percent darker colored soils, 15 percent soils that are slightly more clayey, 10 percent soils that are more than 90 percent limestone pebbles and cobbles, 10 percent Divot soils, and 5 percent other soils. Areas of these soils are so intricately mixed that they could not be separated at the scale used in mapping.

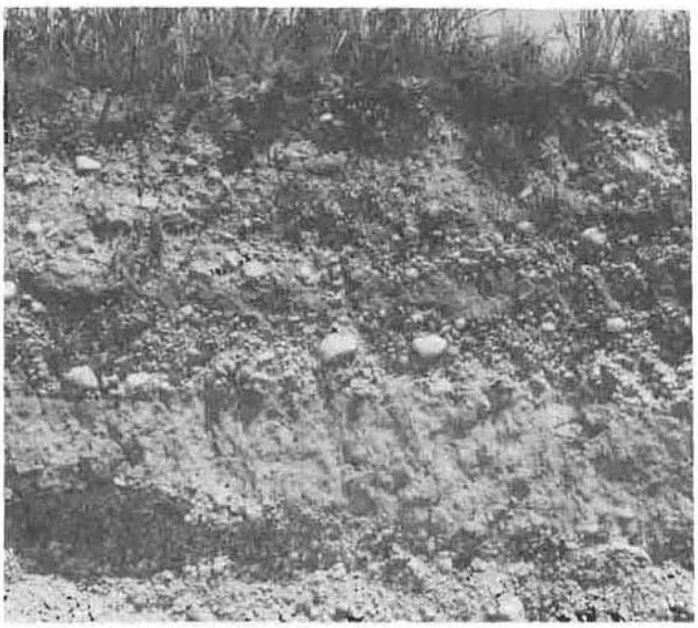

Figure 10.—Profile of Orif loam, exposed in an open gravel pit near the Medina River. In the soil are large amounts of coarse fragments and stratified layers of soil material.

These soils are flooded one or more times in 1 to 4 years. They are not suited to cultivation because of the hazard of flooding and the content of gravel. Almost all areas of this complex are used for range and wildlife habitat.

On range the main management need is establishing perennial native grass that increases in quality and quantity and protects the soils from erosion. Grazing should be regulated so that half the current year's growth, by weight, of desirable grass is left each year. Brush control, fencing, and water development is needed in places. Capability unit VIw-1, dryland; pasture and hayland group 2A; Loamy Bottomland range site.

Patilo Series

The Patilo series consists of deep, moderately well drained, gently undulating soils on uplands. These soils formed in thick, sandy, eolian material.

In a representative profile the surface layer is fine sand about 48 inches thick. It is brown in the upper 4 inches and very pale brown below. The next layer is mottled, light-gray sandy clay loam, to a depth of 84 inches.

Permeability is moderately slow, and the available water capacity is low.

Patilo soils are used mainly for range. A few areas are used for peanuts, small grains, and watermelons and a few small areas are in improved pasture. Most of the cultivated fields and improved pastures are sprinkler irrigated.

Representative profile of the Patilo fine sand, in an area of Patilo-Eufaula association, gently undulating, 1.4 miles southeast on State Highway 173 from its junction with U.S. Highway 81 in Devine, 4.2 miles east on county road, 1 mile north to ranch entrance, and 1 mile north of gate on a pasture road:

A1—0 to 4 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grained; loose; common roots; slightly acid; clear, smooth boundary.

A2—4 to 48 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) when moist; single grained; loose; common roots in upper part and few in lower part; medium acid; clear, wavy boundary.

B21t—48 to 56 inches, light-gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) when moist; few, medium, distinct, red and yellow mottles; weak, coarse, blocky structure; very hard, firm; clay films are distinct and patchy on ped faces; strongly acid; gradual, wavy boundary.

B22t—56 to 72 inches, light-gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) when moist; common, medium and coarse, prominent, dark-red mottles and few, medium, distinct, yellow mottles; weak, coarse, blocky structure; very hard, firm; clay films are distinct and patchy on ped faces; strongly acid; gradual, smooth boundary.

B3t—72 to 84 inches, light-gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) when moist; many, coarse, prominent, dark-red, red, and yellowish-red mottles; weak, coarse, blocky structure; hard, firm, strongly acid.

The A horizon is 40 to 80 inches thick. It is fine sand or loamy fine sand and is neutral to medium acid. The Al horizon is dark brown, dark grayish brown, grayish brown, brown, light brownish gray, pale brown, or very pale brown. The A2 horizon is brown, very pale brown, light gray, light yellowish brown, or reddish yellow.

The Bt horizon is white, light gray, very pale brown, pale brown, brownish yellow, reddish yellow, yellowish red, yellow, or light yellowish brown. It has mottles in shades of red, yellow, and gray that varies in size and amount. Reaction ranges from slightly acid to strongly acid

PEC—Patilo-Eufaula association, gently undulating. This association consists of dunelike or hummocky soils. It is in broad, irregularly shaped areas of 50 to several hundred acres. Slopes are 1 to 5 percent.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 55 percent Patilo soils, 26

percent Eufaula soils, and 10 percent Nueces soils. The remaining 9 percent consists of Duval, Poth, and Wilco soils. These soils were not mapped separately because their use and management are similar.

Permeability is moderately slow in the Patilo soils and rapid in the Eufaula soils. The hazard of soil blowing is high.

Most areas of these soils are used for range. In a few areas, blackjack and post oak trees have been removed and the soils are cultivated. Open areas are used for improved pasture.

Management needs for cultivated fields include using crops that help protect the soils from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soils during the growing season. Management of plant residue and frequent, light applications of fertilizer help to improve tilth, reduce evaporation, and reduce the hazard of soil blowing. These soils should be kept in permanent vegetation.

Sprinkler irrigation systems are best suited to these soils. Coastal bermudagrass responds well to irrigation and fertilization. Buffelgrass and weeping lovegrass are also suitable pasture plants. Among management needs for pasture are weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. The main management need for range is the control of soil blowing. Capability unit IIIs-1, irrigated, but Patilo part in capability unit IIIs-3, dryland, and Eufaula part in capability unit IVs-1, dryland; pasture and hayland group 9B; Deep Sand Savannah range site.

Poth Series

The Poth series consists of deep, well-drained, nearly level or gently sloping soils on uplands. These soils formed in loamy material, several feet thick, that has thin strata of sandstone and shale.

In a representative profile the surface layer is loamy fine sand about 26 inches thick. It is light yellowish brown in the upper 12 inches and very pale brown below. In the upper 16 inches of the next layer is yellowish-brown and light yellowish-brown sandy clay that has yellowish-red, brown, brownish-yellow, and reddish-yellow mottles. In the next 10 inches it is light yellowish-brown and brownish-yellow sandy clay loam that has yellowish-red mottles and, in the lower 4 inches, contains a few weakly cemented masses of calcium carbonate. Below this, to a depth of 80 inches, is reddish-yellow sandy clay loam that has red and yellow mottles and a few soft masses of calcium carbonate.

Permeability is slow, and the available water capacity is medium.

Poth soils are used mainly for peanuts, grain sorghum, small grains, and watermelons. A small acreage is irrigated. Improved varieties of grass are grown for forage.

Representative profile of Poth loamy fine sand, 0 to 3 percent slopes, in an idle field, 1.1 miles northeast on U.S. Highway 81 from its junction with State Highway 173 in Devine, 0.3 mile west on county road to Devine City Cemetery, 0.8 mile north on county road, and 100 yards east:

A11—0 to 12 inches, light yellowish-brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) when moist; single grained; loose, very friable; many fine roots; slightly acid; clear, smooth boundary.

A12—12 to 26 inches, very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) when moist; single grained; loose, very friable; common fine roots; slightly acid; clear, wavy boundary.

B21t—26 to 36 inches, yellowish-brown (10YR 5/4) sandy clay, dark yellowish brown (10YR 4/4) when moist; common, fine and medium, distinct, yellowish-red (5YR 5/6), brown (10YR 5/3), and brownish-yellow (10YR 6/6) mottles; moderate,

medium, blocky structure; extremely hard, very firm; few roots and fine pores; thin clay films on peds; few black-brown concretions; few old root channels filled with darker material; few streaks and seams of light yellowish-brown (10YR 6/4) sandy material, mainly between peds; neutral; gradual, wavy boundary.

B22t—36 to 42 inches, light yellowish-brown (10YR 6/4) sandy clay, yellowish brown (10YR 5/4) when moist; common, fine and medium, faint and distinct, reddish-yellow (7.5YR 6/6) and brown (10YR 5/3) mottles; moderate, fine and medium, blocky structure; extremely hard, very firm; few roots and fine pores; thin patchy clay films on peds; few old root channels filled with darker material; few streaks of lighter colored sandy material in cracks and seams; mildly alkaline; gradual, wavy boundary.

B23t—42 to 48 inches, light yellowish-brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) when moist; common, medium and coarse, faint and distinct, yellowish-red (5YR 5/6) and brownish-yellow (10YR 6/6) mottles; weak, medium, blocky structure; very hard, firm; few, thin, patchy clay films on peds; few old root channels filled with darker material; few streaks of light-colored sandy material; few black-brown concretions; mildly alkaline; gradual, wavy boundary.

B24t—48 to 52 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) when moist; common, medium and coarse, distinct mottles or splotches of yellowish red (5YR 5/6) and few, fine, faint, yellowish and brownish mottles; weak, fine, subangular blocky structure; very hard, firm; few patchy clay films; few black-brown concretions; few, fine, weakly cemented calcium carbonate concretions; matrix is noncalcareous; moderately alkaline; gradual, wavy boundary.

B3t—52 to 80 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) when moist; few yellow and red mottles; weak, fine, subangular blocky structure; hard, friable; few, fine and very fine, soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 20 to 38 inches thick. It is light brown, pale brown, pink, light yellowish brown, brown, or. very pale brown. Reaction is slightly acid or neutral.

The B2t horizon is 18 to 50 inches thick. It is light yellowish brown, strong brown, brownish yellow, light brown, pale brown, reddish yellow, or yellowish brown and has mottles in shades of red, yellow, or brown. It is sandy clay loam or sandy clay. Reaction ranges from slightly acid in the upper part to moderately alkaline in the lower part.

The B3t horizon is reddish yellow and has mottles in shades of red, gray, or yellow. Reaction is neutral to moderately alkaline. Some profiles lack the B3t horizon.

PoB—Poth loamy fine sand, 0 to 3 percent slopes. This nearly level to gently sloping soil is in rounded to irregularly shaped areas of about 20 to 150 acres.

Included with this soil in mapping are small areas of Miguel soils in low narrow strips along drainageways. Also included are small areas of Nueces, Webb, and Wilco soils on slight knolls or at the top of slopes.

Surface runoff is slow. The hazard of soil blowing is moderate.

Management needs for cultivated fields include using crops that help protect the soil from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing sea-sons. Management of plant residue and frequent, light applications of fertilizer help to conserve moisture and maintain tilth and productivity. A well-designed irrigation system and proper water management are needed on irrigated land. Sprinkler irrigation systems are best suited to this soil.

Suitable pasture and hay plants are improved bermudagrass, weeping lovegrass, buffelgrass, and other introduced grasses. Management needs for pasture include

fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-9, dryland, and IIIe-10, irrigated; pasture and hayland group 9A; Sandy range site.

Pratley Series

The Pratley series consists of moderately deep, well-drained, nearly level to gently sloping soils on uplands. These soils formed in clayey material over limestone.

In a representative profile the surface layer is very dark grayish-brown clay about 10 inches thick. The next layer is 23 inches thick. In the upper 10 inches it is brown clay and a few fine limestone fragments. In the lower 13 inches it is reddish-brown clay and a few fine limestone and caliche fragments. The underlying material, to a depth of 48 inches, is caliche that is indurated and laminar in the upper 1 inch and weakly cemented below that depth.

Permeability is moderately slow, and the available water capacity is medium.

Pratley soils are used mainly for range and wildlife habitat, but some areas are farmed.

Representative profile of Pratley clay, 0 to 3 percent slopes, 9.1 miles north on Farm Road 462 from its junction with U.S. Highway 90, 2.3 miles west on ranch road to caliche pit, then 100 feet south of road:

A1—0 to 10 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) when moist; moderate, fine, subangular blocky and granular structure; very hard, firm; many fine roots; few fine pores and old root channels; few fine and very fine limestone fragments; calcareous; moderately alkaline; clear, smooth boundary.

B21t—10 to 20 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) when moist; moderate, medium, subangular blocky structure parting to moderate, very fine, angular blocky; very hard, very firm; many fine roots; few fine pores and old root channels; common clay films on peds; few fine and very fine limestone fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B22t—20 to 33 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; moderate, fine and medium, subangular blocky structure parting to moderate, very fine, angular blocky; very hard, firm; few fine roots; clay films on peds; few fine limestone and caliche fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—33 to 34 inches, indurated caliche that is somewhat broken into fragments; the fragments are laminar in the upper part and pitted on the upper surface; calcareous; moderately alkaline; abrupt, wavy boundary.

C2ca—34 to 48 inches, white (10YR 8/2) weakly cemented caliche and limestone.

The thickness of the solum and the depth to cemented caliche range from 22 to 40 inches.

The A horizon is 7 to 15 inches thick. It is dark grayish brown, very dark grayish brown, or dark brown. Reaction ranges from neutral to moderately alkaline.

The B2t horizon is 14 to 30 inches thick. It is dark-brown, brown, or reddish-brown clay or silty clay.

The C1cam horizon ranges from 1 inch of indurated caliche to about 7 inches of broken caliche plates and 5 to 15 percent soil material between the plates. The C2ca horizon ranges from weakly consolidated limestone to interbedded chalk, marl, caliche, and limestone.

PrB—Pratley clay, 0 to 3 percent slopes. This nearly level to gently sloping soil is on uplands, mainly between steeper soils on hills and soils on drainageways. It is mainly in irregularly shaped elongated areas of about 15 to 150 acres.

Included with this soil in mapping are small areas of soils that are very similar to Pratley soils but lack the indurated caliche layers or are deeper than 40 inches to caliche or limestone. Also included are small patches of Brackett, Castroville, Doss, Knippa, Mereta, Real, and Topia soils.

This soil is used mainly for range and wildlife habitat, but a few areas are cultivated. The main crops are small grain, grain sorghum, and introduced grasses. This soil is suitable for cultivation, especially if it is irrigated. The hazard of erosion is moderate.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to conserve moisture, maintain tilth and productivity, and protect and improve the soil between growing seasons. Terraces and contour tillage help control erosion and conserve moisture. In some places grassed waterways are needed to safely dispose of excess water and control erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIe-2, dryland, and IIe-4, irrigated; pasture and hayland group 7C; Clay Loam range site.

Quihi Series

The Quihi series consists of moderately deep, well-drained, gently sloping to sloping and gently undulating soils on uplands. These soils formed in gravelly clay and clay loam.

In a representative profile the surface layer is gravelly clay loam about 9 inches thick. It is dark brown in the upper 3 inches and very dark brown below. The next layer is 21 inches thick. In the upper 17 inches it is dark reddish-brown very gravelly clay. In the lower 4 inches it is red gravelly clay. Beneath that, to a depth of 46 inches, is very pale brown to white caliche that is strongly cemented in the upper 1 inch and weakly cemented below.

Permeability is moderately slow, and the available water capacity is low.

Almost all areas of these soils are used for range and wildlife habitat. Some small areas are in small grains that are used mainly for winter grazing by livestock.

Representative profile of Quihi gravelly clay loam, in an area of Quihi association, gently undulating, in range, 13.1 miles east on U.S. Highway 90 from its intersection with State Highway 173, 1 mile northwest on paved county road, and 50 feet north of fence line:

A11—0 to 3 inches, dark-brown (7.5YR 3/2) gravelly clay loam, very dark brown (7.5YR 2/2) when moist; moderate, fine and very fine, subangular blocky and granular structure; hard, friable; many fine roots; about 15 percent is rounded chert pebbles, mainly ½ to 2 inches in diameter; neutral; clear, wavy boundary.

A12—3 to 9 inches, very dark brown (7.5YR 2/2) gravelly clay loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, subangular blocky structure; hard, friable; many fine roots; about 25 percent is rounded chert pebbles, mainly to 3 inches in diameter; few chert cobbles and stones; neutral; clear, wavy boundary.

B21t—9 to 18 inches, dark reddish-brown (5YR 3/3) very gravelly clay, dark reddish brown (5YR 2/2) when moist; moderate, fine, blocky structure; very hard, firm; common fine roots; few fine pores; about 75 percent is rounded chert pebbles, mainly to 2 inches in diameter; few cobbles; thin clay films on faces of peds and coarse fragments; neutral; gradual, wavy boundary.

B22t—18 to 26 inches, dark reddish-brown (2.5YR 3/4) very gravelly clay, dark reddish brown (2.5YR 2/4) when moist; moderate, fine, blocky structure; very hard, firm; few fine roots; about 65 percent is rounded chert pebbles as large as 2 inches in diameter; thin clay films on faces of peds and coarse fragments; mildly alkaline; clear, wavy boundary.
B23t—26 to 30 inches, red (2.5YR 5/6) gravelly clay, red (2.5YR 4/6) when moist; few, fine, faint mottles of light yellowish brown (2.5YR 6/4); moderate, medium, blocky structure; very hard, firm; few roots; about 15 percent is rounded chert pebbles; few patchy clay films on faces of peds and coarse fragments; calcareous; moderately alkaline; abrupt, wavy boundary.
C1cam—30 to 31 inches, very pale brown (10YR 7/3) strongly cemented caliche; about 10 percent is chert pebbles; calcareous; abrupt, wavy boundary.
C2ca—31 to 46 inches, white (10YR 8/2) weakly cemented caliche; few chert pebbles; massive; calcareous; moderately alkaline.

The thickness of the solum and the depth to cemented caliche range from 20 to 40 inches. Coarse fragments are mainly rounded chert pebbles and cobbles.

The A horizon is 4 to 14 inches thick. It is dark brown, dark grayish brown, very dark brown, dark reddish brown, or reddish brown and is gravelly clay loam, gravelly sandy clay loam, sandy clay loam, or clay loam. Coarse fragments make up about 5 to 50 percent of this horizon. Reaction ranges from slightly acid to mildly alkaline.

The B2t horizon is 12 to 30 inches thick. It is dark reddish gray, reddish brown, dark reddish brown, dusky red, dark brown, or red gravelly or very gravelly clay. A few yellowish or brownish mottles are in the lower part of this horizon in some places. Coarse fragments make up 35 to 85 percent, by volume, of the upper part of the B2t horizon and less than 20 percent of the lower part. This horizon ranges from slightly acid in the upper part to moderately alkaline in the lower part and is generally more alkaline with increasing depth.

The C horizon ranges from strongly cemented caliche to weakly consolidated, pinkish limy earth of clay loam texture. The upper part is laminar in most places.

QUC—Quihi association, gently undulating. This association consists of gravelly clay loams on uplands. It is in rounded to irregularly shaped areas of 25 to 350 acres. Slopes range from 1 to 5 percent. The Quihi soils in this association have the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 65 percent Quihi soils and very similar soils that are less clayey, 10 percent Monteola gravelly clay, and 10 percent Yologo and Hindes soils. The remaining 15 percent consists of Hanis soils in slightly lower areas and Olmos and Speck soils in slightly higher areas. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium. The hazard of erosion is moderate, especially where the soils are bare. Coarse fragments on the surface help to reduce erosion to some extent by increasing water intake and reducing evaporation.

Quihi soils are not suited to cultivation because they contain a large amount of coarse fragments (fig. 11). Nearly all areas of this association are used for range or wildlife habitat. Some of the less gravelly areas are used for forage crops or small grains. These crops are used mainly for winter grazing by livestock and wildlife.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability unit IVs-2, dryland; pasture and hayland group 7C; Clay Loam range site.

QvD—Quihi and Devine soils, 1 to 8 percent slopes. This undifferentiated group consists of gently sloping to sloping, gravelly soils on uplands. The areas are 5 to 25 acres on rounded knolls, mainly within large areas of similar soils.

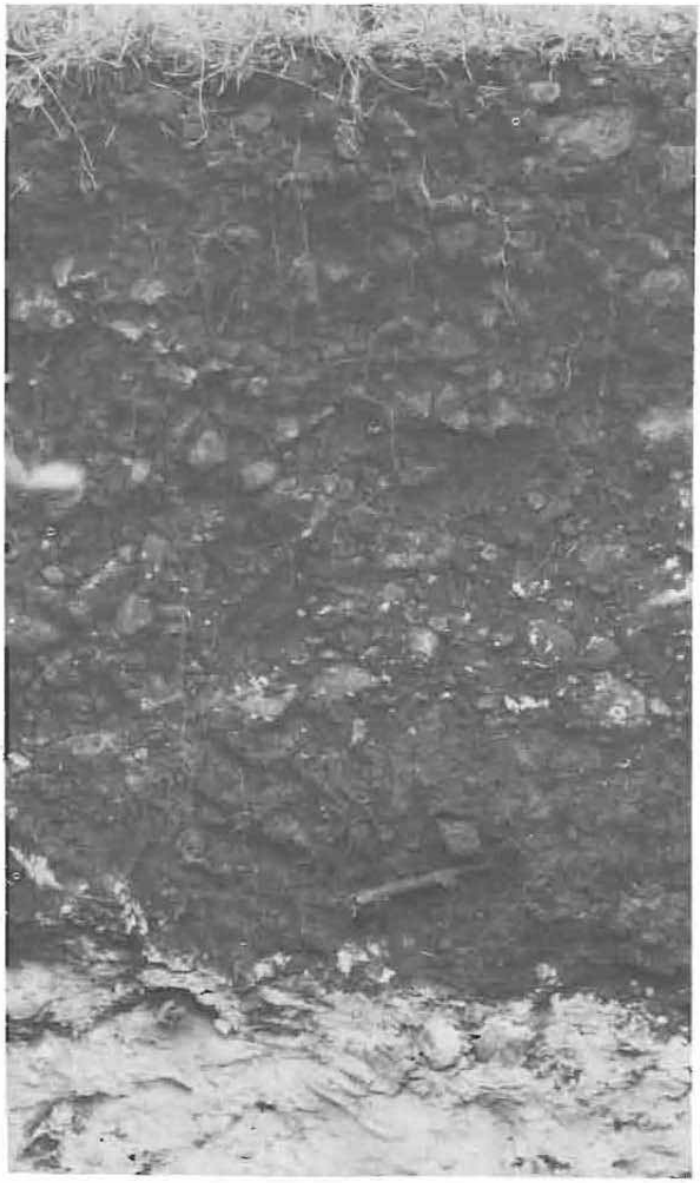

Figure 11.—Profile of Quihi gravelly clay loam.

This mapping unit is about 55 percent Quihi gravelly clay loam, 23 percent Devine gravelly sandy loam, and 10 percent Yologo soils. The remaining 12 percent consists of Duval, Hanis, and Webb soils. In some places mapped areas are mostly Quihi or Devine soils and less than 15 percent other soils.

The Quihi soil has a surface layer of dark-brown gravelly clay loam about 8 inches thick. Below this, to a depth of 26 inches, is dark reddish-brown very gravelly clay and about 70 percent chert pebbles. The underlying material is soft caliche that is strongly cemented in the upper few inches.

The Devine soil has a surface layer, about 10 inches thick, of brown gravelly sandy loam and about 35 percent rounded chert pebbles. In the next 32 inches is light-brown very gravelly sandy loam and about 60 percent chert pebbles and some cobbles. In the 40 inches below this is reddish-brown very gravelly sandy clay and about 75 percent rounded chert pebbles and cobbles. Beneath this is yellowish-red sandy clay loam and a few pebbles.

The Quihi and Devine soils are well drained. Surface runoff is medium, and the hazard of erosion is moderate. Permeability is generally slow but is rapid in the surface layer of the Devine soils. The available water capacity is low.

Almost all areas of these soils are used for range. A few small areas, mainly of Quihi soils, are cultivated. The cropping system should provide a large amount of lilant residue, and the residue should be left on or near the surface. Capability unit Ivs-2, dryland; Quihi part in pasture and hayland group 7C, and Clay Loam range site; Devine part in pasture and hayland group 9B and Gravelly Ridge range site.

Real Series

The Real series consists of very shallow or shallow, well-drained, gently sloping to sloping and undulating soils on uplands. These soils formed in weakly cemented limestone and chalk that are interbedded with thin layers of marl and indurated limestone in some places.

In a representative profile the surface layer is about 13 inches thick. In the upper 4 inches it is very dark grayish-brown gravelly clay loam and contains about 10 percent weakly cemented limestone fragments. In the lower 9 inches it is dark grayish-brown very gravelly clay loam and contains about 70 percent flat limestone fragments. Beneath this, to a depth of 20 inches, is weakly cemented limestone. The upper part of the limestone, about 1 inch thick, is somewhat platy and is harder than the material below (fig. 12).

Permeability is moderate, and the available water capacity is very low.

Real soils are used for range and wildlife habitat. Roadbed materials have been mined from open pits in some places.

Representative profile of Rehm gravelly clay loam, in an area of Real association, undulating, in native range, 6.3 miles north on Farm Road 689 from its junction with U.S. Highway 90, 1.1 miles east on county road, and 100 feet north of road and 25 feet west of fence:

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) gravelly clay loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky and granular structure; hard, friable; many fine and medium roots; about 10 percent, by volume, is weakly cemented limestone fragments as large as 3 inches; few cobble- and stone-sized fragments; fragments are mainly flat and are about ½ to 1 inch thick; calcareous; moderately alkaline; abrupt, wavy boundary.A12—4 to 13 inches, dark grayish-brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky and granular structure; hard, firm but crumbly; many roots between coarse fragments; about 70 percent is flat, weakly cemented limestone fragments as large as 3 inches; common cobble- and stone-sized fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

C—13 to 20 inches, weakly cemented white or yellow limestone; the upper 1 inch is somewhat platy and is harder than the material below; few seams of fine earth, mainly in upper part; few seams of soft chalk.

The solum is 8 to 20 inches thick and is underlain by weakly cemented limestone, caliche, or chalk. Limestone fragments make up 35 to 85 percent, by volume, of the solum.

The A horizon is dark gray, very dark gray, grayish brown, dark grayish brown, very dark grayish brown, or brown. It is gravelly or very gravelly clay loam or loam.

The upper ¼ to 3 inches of the C horizon are somewhat harder and more platy and fractured than the material below. Thin seams and pockets of soil and chalk are in this horizon in some places.

Figure 12.—Profile of Real gravelly clay loam, in a road cut. Material in the lower part is weakly cemented limestone.

RED—Real association, undulating. This association consists of gravelly clay loams on uplands, mostly on foot slopes between steeper soils on hills, and soils in valleys. Most areas are broad and elongated and range from one to several hundred acres in size. Slopes range from 1 to 8 percent. The Real gravelly clay loam in this association has the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 65 percent Real soils and about 20 percent similar soils that are less than 10 inches deep. The remaining 15 percent consists of Brackett, Doss, Kavett, Mereta, Pratley, Speck, and Tarrant soils. Rock crops out in many areas. These soils were not mapped separately because their use and management are similar.

Surface runoff is rapid, and the hazard of erosion is severe. Sheet erosion has removed part of the surface layer in some places, and a few rills and shallow gullies have formed, especially where the soils are bare. In some places extra moisture is received from steeper soils at a higher elevation. Capability unit VIs-1, dryland; not in a pasture and hayland group; Adobe range site.

RkD—Real and Brackett soils, 1 to 8 percent slopes. This undifferentiated group consists of gently sloping to sloping gravelly loams or gravelly clay loams. Areas are 5 to 30 acres in size. These soils are mainly on foot slopes below limestone hills and above narrow valleys. They are also on low knolls within larger mapped areas of similar soils.

This mapping unit is about 47 percent Real soil and 28 percent Brackett soil. The remaining 25 percent is mainly Doss and Mereta soils. Mapped areas can be mostly Real or mostly Brackett soils and less than 15 percent other soils in some places.

In a profile of the Real soil in this mapping unit, the surface layer is about 14 inches thick. In the upper 4 inches it is very dark grayish-brown gravelly clay loam and contains about 15 percent flat limestone fragments. In the lower 10 inches it is dark grayish-brown very gravelly clay, loam and about 80 percent flat limestone fragments. The underlying material is weakly cemented limestone. In the upper few inches the limestone is somewhat platy and indurated.

In a profile of the Brackett soil in this mapping unit, the surface layer is light brownish-gray clay loam about 4 inches thick; limestone pebbles and cobbles are scattered on the surface. The next layer is pale-yellow clay loam; it is about 5 percent limestone gravel and has a few soft masses of calcium carbonate. This layer is about 12 inches thick. The underlying material is clayey marl interbedded with layers of strongly cemented limestone.

These soils are well drained. Permeability is moderate in the Real soils and moderately slow in the Brackett soils. The available water capacity is very low.

The soils of this mapping unit are used for range or wildlife habitat. Capability unit VIs-1, dryland; not in a pasture and hayland group; Adobe range site.

Rehm Series

The Rehm series consists of deep, well-drained, undulating soils on uplands. These soils formed in calcareous gravelly, loamy, and shaly material.

In a representative profile the surface layer is dark grayish-brown gravelly clay loam about 11 inches thick.

The next layer is 33 inches thick. In the upper 17 inches it is brown and pale-brown very gravelly clay loam and about 75 percent rounded chert pebbles. In the 6 inches below that it is pale-brown very gravelly clay loam, about 75 percent calcium-coated chert pebbles, and about 10 percent strongly cemented calcium carbonate concretions. In the lowermost 10 inches it is very pale brown very gravelly clay loam, about 25 percent soft lumps and strongly cemented concretions of calcium carbonate, and 50 percent, by volume, calcium-coated chert pebbles. The underlying material, to a depth of 96 inches, is light yellowish-brown shaly clay.

Permeability is moderate, and the available water capacity is low.

Rehm soils are not suited to farming because of their slope and content of gravel. Nearly all the acreage is used for range and wildlife habitat.

Representative profile of Rehm gravelly clay loam, in an area of Rehm complex, 1 to 8 percent slopes, in range, 5.3 miles south on Farm to Market Road 2200 from its junction with U.S. Highway 90 in D'Hanis, then 220 feet south of right-of-way, about 400 feet northwest of windmill:

A1—0 to 11 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots, fine pores, and old root channels; about 20 percent, by volume, is rounded chert pebbles, mainly ½ to 2 inches in diameter; calcareous; moderately alkaline; clear, smooth boundary.

B21—11 to 20 inches, brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine roots, fine pores, and old root channels; about 75 percent, by volume, is rounded chert pebbles, mainly 1 to 3 inches in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B22—20 to 28 inches, pale-brown (10YR 6/3) very gravelly clay loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; few roots; about 75 percent, by volume, is rounded chert pebbles; a few of the pebbles coated with calcium carbonate; few calcium carbonate concretions in lower part; calcareous; moderately alkaline; gradual, wavy boundary.

B31ca—28 to 34 inches, pale-brown (10YR 6/3) very gravelly clay loam, brown (10YR 5/3) when moist; moderate, fine, subangular blocky structure; hard, friable; about 75 percent, by volume, is calcium-coated chert pebbles; about 10 percent, by volume, is strongly cemented calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

B32ca—34 to 44 inches, very pale brown (10YR 7/4) very gravelly clay loam, light yellowish brown (10YR 6/4) when moist; weak, fine, subangular blocky structure; hard, friable; about 25 percent, by volume, is soft lumps and strongly cemented concretions of calcium carbonate; about 50 percent, by volume, is calcium-coated chert pebbles; calcareous; moderately alkaline; abrupt, smooth boundary.

C—44 to 96 inches, light yellowish-brown (2.5Y 6/4) shaly clay, light olive brown (2.5Y 5/4) when moist; massive; many streaks and splotches of olive yellow and yellowish brown; many pockets of soft, whitish calcium carbonate masses that diminish with depth; calcareous; moderately alkaline.

The thickness of the solum and the depth to shaly clay or weakly consolidated sandstone range from 30 to 60 inches. Coarse fragments, mainly rounded chert, make up 35 to 80 percent, by volume, between depths of 10 and 40 inches.

The A horizon is 10 to 16 inches thick. It is grayish brown or dark grayish brown and ranges from gravelly loam to gravelly clay loam.

The B horizon is 10 to 40 inches thick. It is grayish brown, brown, pale brown, very pale brown, light yellowish brown or dark grayish brown and ranges from gravelly or very gravelly loam to gravelly or very gravelly clay loam. The Bca horizon contains 20 to 40 percent visible lumps and concretions of calcium carbonate.

The C horizon ranges from shaly clay to weakly consolidated sandstone that has seams and pockets of limy material.

RmD—Rehm complex, 1 to 8 percent slopes. This complex consists of undulating gravelly clay loam on uplands. It is mainly in long, oval or irregularly shaped areas of about 20 to 250 acres.

This complex is about 40 percent Rehm soils, 15 percent Olmos soils, 10 percent Yologo soils, 10 percent Valco soils, and 10 percent Hindes soils. The remaining 15 percent consists of Amphion, Castroville, Hanis, and Lacoste soils. These soils are so intricately mixed that it is not feasible to separate them at the scale used in mapping.

These soils are not suitable for cultivation because of the slope, content of gravel, and susceptibility to erosion. Al-most all areas are used for range and wildlife habitat. Capability unit VIs-3, dryland; not in a pasture and hayland group; Shallow, Rio Grande Plain, range site.

Rock Outcrop

Rock outcrop is exposed limestone bedrock. It is in hilly to steep areas mainly in bands a few feet wide. The soils between the bands are shallow to very shallow and are covered with limestone pebbles, cobbles, stones, and boulders. Rock outcrop is also on the upper part of slopes, caps of hills or ridges, and walls of canyons or escarpments.

Rock outcrop is weakly to strongly fractured. The fractures contain soil material that supports a few grasses, forbs, and small trees.

In Medina County, Rock outcrop is mapped only in associations with Brackett and Tarrant soils.

Sabenyo Series

The Sabenyo series consists of deep, well-drained, gently sloping soils on uplands. These soils formed in loamy material weathered from limestone.

In a representative profile the surface layer is pale-brown clay loam about 10 inches thick. The next layer is 42 inches thick. In the upper 7 inches it is light-brown clay loam and about 3 percent calcium carbonate concretions. In the lower 35 inches it is pink clay loam and about 25 to 30 percent calcium carbonate concretions and masses. Below this to a depth of 85 inches is pink sandy clay loam.

Permeability is moderate, and the available water capacity is medium.

Sabenyo soils are used for crops and range. The main crops are small grains, grain sorghum, and introduced grasses. A small acreage is sprinkler irrigated. Thick patches of thorny brush have invaded many areas of range.

Representative profile of Sabenyo clay loam, 1 to 5 percent slopes, in a cultivated field, 1.7 miles north on Farm Road 471 from its junction with U.S. Highway 90 in Castroville, 0.4 mile west on county road, then 100 feet north:

Ap—0 to 5 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable; common fine and medium roots; few fine pores, worm casts, and tunnels; few snail fragments; few calcium carbonate concretions as much as '/4 inch in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—5 to 10 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; common fine roots; few fine pores; few worm casts and snail fragments; few calcium carbonate concretions as much as 1¼ inch in diameter; calcareous; moderately alkaline; clear, smooth boundary.

B21—10 to 17 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) when moist; moderate, medium and fine, subangular blocky structure; hard, friable; common fine roots; few fine pores; common worm casts and tunnels; about 3 percent calcium carbonate concretions as much as ½ inch in diameter; calcareous; moderately alkaline; clear, wavy boundary.

B22ca—17 to 37 inches, pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) when moist; weak, fine and medium, subangular blocky structure; hard, friable; few fine roots and pores; about 30 percent pinkish-white (7.5YR 8/2) calcium carbonate concretions and segregated masses as much as ¾ inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B23ca—37 to 52 inches, pink (7.5YR 7/4) clay loam, pink (7.5YR 7/4) when moist; weak, fine, subangular blocky structure; hard, friable; few fine pores; about 25 percent pinkish-white (7.5YR 8/2) calcium carbonate concretions and segregated masses as much as 1 inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—52 to 85 inches, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) when moist; slightly hard, friable; calcareous; moderately alkaline.

The solum is 40 to 70 inches thick.

The A horizon is 6 to 14 inches thick. It is light brownish gray, pale brown, light gray, grayish brown, or brown.

The B horizon is 30 to 55 inches thick. It is pink, light brown, pale brown, very pale brown, strong brown, brown, or reddish yellow and is clay loam or loam. The upper part is typically 3 to 10 percent weakly cemented calcium carbonate concretions. The lower part is about 25 percent weakly cemented calcium carbonate concretions.

The Cca horizon is pink, light brown, very pale brown, or reddish yellow and is sandy clay loam or sandy loam.

SaC—Sabenyo clay loam, 1 to 5 percent slopes. This gently sloping soil is on stream terraces and foot slopes in narrow valleys. It is mainly on beveled slopes between soils on broad terraces and soils on flood plains. Areas of this soil are typically long and narrow and parallel the streams. They range from 10 to 350 acres in size.

Included with this soil in mapping are small areas of Atco, Castroville, and Knippa soils. Also included are similar soils that have a thinner, eroded surface layer.

Runoff is medium, and the hazard of water erosion is moderate. There are a few, small, crossable rills and gullies in some cultivated areas.

Among the management needs for cultivated fields are using crops that help protect the soil during the growing season and that furnish sufficient residue to conserve moisture, maintain tilth and productivity, and protect and improve the soil between growing seasons. Terraces and contour tillage help control erosion and conserve moisture. The rills and gullies are generally eliminated during normal tillage and are little or no hazard to farm equipment. In some places grassed waterways are needed to safely dispose of excess water and control erosion. A well-designed irrigation system and proper water management are needed on irrigated soils.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IVe-2, dryland, and IIIe-7, irrigated; pasture and hayland group 13A; Shallow, Rio Grande Plain, range site.

Speck Series

The Speck series consists of shallow, well-drained, undulating soils on uplands. These soils formed in loamy to clayey material over limestone.

In a representative profile the surface layer is dark-brown clay loam about 7 inches thick. The next layer is dark reddish-brown clay about 8 inches thick. Fractured, hard limestone bedrock is at a depth of 15 inches.

Permeability is slow, and the available water capacity is low.

Nearly all areas of this soil are used for range and wildlife habitat, although a few small areas are used for dryfarmed small grain and hay.

Representative profile of Speck clay loam, in an area of Speck association, undulating, 9 miles north on Farm Road 689 from its junction with U.S. Highway 90, 6.6 miles northwest on Burger Road, then 300 feet east of Burger Ranch headquarters:

A1—0 to 7 inches, dark-brown (7.5YR 3/2) clay loam, very dark brown (7.5YR 2/2) when moist; moderate, medium and fine, subangular blocky structure; hard, firm; many fine roots; about 10 percent chert pebbles; mildly alkaline; clear, smooth boundary.

B2t—7 to 15 inches, dark reddish-brown (5YR 3/3) clay, dark reddish brown (5YR 3/3) when moist; moderate, medium and fine, blocky structure; extremely hard, very firm; many fine roots and few pores; clay films on peds; few fine limestone fragments and strongly cemented calcium carbonate concretions, mainly in lower part; neutral; abrupt, wavy boundary.

R—15 inches, fractured, hard limestone bedrock; traces of soil material from other horizons in the cracks and fissures; calcareous.

The thickness of the solum and the depth to limestone bedrock or limestone conglomerate range from 14 to 20 inches. Reaction ranges from mildly alkaline to slightly acid. Coarse fragments range from a few to 15 percent on the surface and in the soils. Cobbles and stones are limestone or chert. The pebbles are chert; they are mainly rounded or angular and are iron stained in many places. Secondary lime ranges from a few concretions or fragments just above the limestone to very thin coatings on the limestone bedrock.

The A horizon is 7 to 9 inches thick. It is dark grayish brown, dark brown, brown, or reddish brown. It is clay or clay loam.

The Bt horizon is 7 to 11 inches thick. It is dark reddish brown to brown.

SPD—Speck association, undulating. This association consists of shallow soils on uplands, mainly between steeper soils on hills and soils on drainageways. It is mainly in rounded to irregularly shaped areas. The areas range from about 25 to more than 300 acres but are typically 75 to 100 acres. Slopes range from 1 to 8 percent but are mainly 1 to 3 percent. The Speck clay loam in this association has the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 50 percent Speck clay loam, 10 percent a similar soil that is very gravelly, 10 percent a similar soil that is less than 10 inches deep to limestone, 5 percent Topia soils, 5 percent Dina soils, 5 percent Kavett soils, 5 percent Tarrant soils, and 10 percent other soils. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used mostly for range and wildlife habitat. A few small areas are used for crops. Capability unit VIs-2, dryland; not in a pasture and hayland group; Redland range site.

Tarrant Series

The Tarrant series consists of very shallow to shallow, well-drained, undulating to steep soils on uplands. These soils formed in clayey material weathered mainly from limestone.

In a representative profile the surface layer is cobbly clay about 16 inches thick. It is very dark grayish brown in the upper 8 inches and dark brown below. Fractured, hard limestone bedrock is at a depth of 16 inches.

Permeability is moderately slow, and the available water capacity is low.

Tarrant soils are used for range and wildlife habitat.

Representative profile of Tarrant cobbly clay, in an area of Tarrant-Rock outcrop association, undulating, in native range, 1.7 miles north of Medina Lake Dam on county road, 0.1 mile east on Ranch Road 1608, and 50 feet south:

A11—0 to 8 inches, very dark grayish-brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) when moist; strong, very fine, subangular blocky and medium granular structure; hard, firm; common roots; about 25 percent cobble-sized angular limestone fragments and about 5 percent pebble-sized fragments; common stone-sized fragments randomly oriented; some fragments are coated with secondary calcium carbonate; calcareous; moderately alkaline; clear, irregular boundary.

A12—8 to 16 inches, dark-brown (7.5YR 3/2) cobbly clay, very dark brown (7.5YR 2/2) when moist; moderate, very fine, blocky and medium granular structure; hard, firm; common roots between coarse fragments; about 80 percent, by

volume, is cobbles and stone-sized fragments and 5 percent pebbles; fragments have some calcium carbonate coatings and pendants; calcareous; moderately alkaline; abrupt, wavy boundary.

R—16 to 24 inches, fractured, hard, platy limestone bedrock; traces of soil material from other horizons in the cracks and fissures; few roots; calcareous; moderately alkaline.

The solum is 6 to 18 inches thick. Limestone and chert fragments cover 30 to 90 percent of the surface. Small amounts of soil material are in thin cracks and crevices in the underlying limestone bedrock.

The A11 horizon is 4 to 10 inches thick. It is brown, dark brown, dark grayish brown, or very dark grayish brown and is cobbly clay, very cobbly clay, or cobbly silty clay. Angular limestone fragments make up 30 to 50 percent of the All horizon and 75 to 90 percent of the Al2 horizon. About 25 to 65 percent of these fragments are larger than 3 inches in diameter. The Al2 horizon is 4 to 10-inches thick. It is dark brown, brown, dark grayish brown, very dark brown, or very dark grayish brown.

TAD—Tarrant-Rock outcrop association, undulating. This association consists of cobbly clays on broad uplands, mainly on foothills at the base of the steeper Tarrant-Rock outcrop association or on long, narrow ridgetops. It is in long and narrow to irregularly shaped areas that cover 20 to more than 500 acres. Slopes are mainly 1 to 6 percent but range to 8 percent. The surface cover of coarse fragments averages about 15 percent stones, 35 percent cobbles, and 15 percent gravel (fig. 13). The Tarrant cobbly clay in this association has the profile described as representative of the series.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is 50 percent Tarrant soils, 11 percent Rock outcrop, and 39 percent Real, Kavett, Pratley, Speck, and soils that are similar to Tarrant soils but are clay loam, are less than 6 inches thick, or are noncalcareous in the surface layer. These soils were not mapped separately because their use and management are similar.

Figure 13.—Area of Tarrant-Rock outcrop association, undulating, where angular fragments of limestone are on the surface.

These soils are well drained. Surface runoff is rapid, and the hazard of erosion is moderate. Coarse fragments on the surface reduce erosion to some extent by slowing runoff, increasing water intake, and limiting evaporation.

These soils are used for range and wildlife habitat. Tarrant part in capability unit Vlls-3, dryland, and Low Stony Hill range site; Rock outcrop in capability unit VIIIs-1, dryland, but not in a range site. Not in a pasture and hayland group.

TAF—Tarrant-Rock outcrop association, hilly. This association consists of cobbly clays on hills or canyon walls. Most areas are irregularly shaped, but some are long and narrow, particularly on steep slopes along streams and canyons. The areas cover 20 to several hundred acres. Slopes are mainly 10 to 20 percent but range to 30 percent in some areas. This association has more coarse fragments on the surface and a greater percentage of Rock outcrop than the less sloping Tarrant-Rock outcrop association.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 62 percent Tarrant soils, 18 percent Rock outcrop, and 20 percent Brackett, Kavett, Real, Speck, and soils that are similar to Tarrant soils but are less than 6 inches deep or are noncalcareous. In some areas steep escarpments are included. The soils of this association were not mapped separately because their use and management are similar.

In the Tarrant soil, angular limestone fragments cover about 75 percent of the surface. The surface layer is about 12 inches thick. In the upper 5 inches it is very dark grayish-brown cobbly clay and about 35 percent angular limestone fragments. In the lower 7 inches it is about 90 percent limestone fragments, and dark-brown cobbly clay is in the cracks and spaces between the fragments. Hard, fractured limestone bedrock is at a depth of 12 inches. Some soil material is in the thin cracks and fractures in the bedrock.

The soils in this association are well drained. Surface runoff is rapid, and the hazard of erosion is high. Coarse fragments help to control erosion and limit evaporation.

These soils are used for range and wildlife habitat. Tarrant part in capability unit VIIs-3, dryland, and Low Stony Hill range site. Rock outcrop in capability unit VIIIs-1, dryland, but not in a range site. Not in a pasture and hayland group.

TBG—Tarrant-Rock outcrop-Brackett association, steep. This association consists of cobbly clays and clay loams on escarpments and valley walls. It is mostly in long, narrow areas that cover 100 to several hundred acres. Slopes range from 20 to 45 percent but are typically 30 to 40 percent.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 21 percent Tarrant soil, 40 percent Rock outcrop, 25 percent Brackett soil, and 14 percent Kavett, Mereta, Real, and Speck soils. Included with these soils in mapping are soils that are similar to the Tarrant soil but are less than 6 inches deep or are noncalcareous and Pratley soils in some areas along narrow drainageways. The soils making up this association were not mapped separately because their use and management are similar.

The Tarrant soil and Rock outcrop are on the upper part of the slopes and on the top of hills or ridges. The Brackett soils are on the lower part of the slopes.

The Tarrant soil in this association has a surface layer of very dark grayish brown very cobbly clay about 8 inches thick. Below that is limestone bedrock. About 90 percent, by volume, is angular limestone fragments, which are mostly 2 to 8 inches in diameter. These fragments also are scattered on the surface.

In the Brackett soil, weakly and strongly cemented limestone fragments, 2 to 8 inches in size, cover about 60 percent of the surface. The surface layer, about 5 inches thick, is light brownish-gray loam and 5 percent, by volume, limestone

fragments. The next layer, which is 10 inches thick, is pale-brown loam and about 10 percent, by volume, limestone fragments. Below that is platy limestone interbedded with yellowish, clayey marl that extends to a depth of 60 inches.

Rock outcrop consists of exposed ledges of limestone bedrock 5 to more than 100 feet wide and 10 to 150 feet apart. These ledges are typically on contours around hills. In many areas they are covered with a layer of soil material 1 to 2 inches thick. Many stones and boulders are in the spaces between ledges.

The soils making up this association are well drained. Surface runoff is rapid, and the hazard of erosion is high. Many areas are eroded, especially where the soils are not protected by rocks or vegetation.

This association is used for range, mainly for sheep and goats, and for wildlife habitat.

The main management need is establishing and maintaining a good cover of perennial grass. Vegetation receives maximum benefit from small showers because water runs off the rocks and boulders and into the soil-filled cracks and crevices. Tarrant part in capability unit VIIs-4, dryland and Steep Rocky range site; Rock outcrop in capability unit VIIIs-1, dryland, but not in a range site; Brackett part in capability unit VIIs-1, dryland, and Steep Adobe range site. Not in a pasture and hayland group.

TeD—Tarrant and Speck soils, 1 to 8 percent slopes. This undifferentiated group consists of gently sloping to sloping and undulating clays and clay loams. It is in areas of 5 to 30 acres on low, rounded knolls, mainly within larger areas of similar soils.

This mapping unit is about 53 percent Tarrant soils, 25 percent Speck soils, and 22 percent Kavett, Pratley, Real, and Topia soils. Rock outcrop is included in some places. Mapped areas can be mostly Speck or mostly Tarrant soils and less than 15 percent other soils.

The Tarrant soils have a surface layer, about 6 inches thick, of very dark grayish-brown cobbly clay; it consists of about 35 percent limestone fragments. The next layer, which is 8 inches thick, is dark-brown cobbly clay, and it consists of about 85 percent coarse limestone fragments. Below that is indurated, fractured limestone bedrock.

The Speck soils have a surface layer of dark-brown clay loam about 7 inches thick. The next layer, which is 10 inches thick, is dark reddish-brown clay. Below that is fractured, indurated limestone bedrock.

The Tarrant and Speck soils are well drained. Permeability is slow in the Speck soils and moderately slow in the Tarrant soils. The available water capacity is low. The hazard of erosion is moderate.

Almost all areas of this mapping unit are used for range. A few small areas of Speck soils are in small grain, which is used for winter grazing by livestock and deer. Tarrant part in capability unit VIIs-3, dryland, and Low Stony Hill range site; Speck part in capability unit VIs-2, dryland, and Redland range site. Not in a pasture and hayland group.

Tiocano Series

The Tiocano series consists of deep, somewhat poorly drained, nearly level soils on uplands. These soils formed in clayey material.

In a representative profile the surface layer is clay about 30 inches thick. It is dark gray in the upper 5 inches and very dark gray below. The next layer, which is 20 inches thick, is gray clay that has streaks of dark gray. The underlying material is light brownish-gray clay.

Permeability is very slow, and the available water capacity is high. Surface runoff is ponded. These soils crack when dry. The cracks are about inch to more than 2

inches wide at the surface and penetrate several feet into the soil. Water enters the soils rapidly when the cracks are open, but it enters very slowly when the soils are wet and the cracks close.

Almost all areas of these soils are used for range. A few small areas are used for pasture and hayland.

Representative profile of Tiocano clay, in range, 5.2 miles west on Farm Road 2200 from its junction with State Highway 173 in Devine, 2.7 miles north on county road, then 100 feet east of road:

A11—0 to 5 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; few mottles of yellowish brown; moderate, medium, blocky structure; extremely hard, very firm; many fine roots; cracks that are 2 inches wide; neutral; clear, smooth boundary.

A12—5 to 30 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; distinct intersecting slickensides, especially in the lower part, breaking to weak, coarse, blocky structure; extremely hard, very firm; cracking evident, especially in upper part; peds have shiny faces; neutral; diffuse, wavy boundary.

AC—30 to 50 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; massive but some weak, medium and coarse, blocky structure; extremely hard, very firm; few streaks of dark gray along old closed cracks; noncalcareous; moderately alkaline; diffuse, wavy boundary.

C—50 to 60 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) when moist; massive; extremely hard, very firm; few cemented calcium carbonate concretions smaller than 1 millimeter; noncalcareous; moderately alkaline.

When dry, these soils have cracks that are ½ inch to more than 2 inches wide and extend to a depth of more than 20 inches. In some places there are a few coarse fragments of chert or limestone. Reaction ranges from neutral to moderately alkaline.

The A horizon is about 20 to 50 inches thick. It is dark gray or very dark gray. The AC horizon is 8 to 24 inches thick. It is gray or dark-gray clay or silty clay. Depth to the C horizon is 40 to 60 inches. The C horizon is grayish brown, light brownish gray, light gray, or pale brown.

To—Tiocano clay. This nearly level soil is in slight depressions that are 1 to 3 feet lower than the surrounding soils. It is typically in rounded areas of about 1 to 15 acres. Slopes are mainly less than 0.5 percent.

Included with this soil in mapping are small areas of Victoria soil on the outer edges of this mapping unit. Also included are small areas of clayey soils that have thin overburden of clay loam or sandy clay loam.

This soil receives extra water as runoff from surrounding soils. Because of inadequate surface drainage and very slow internal drainage, water ponds on the soil for periods of 1 to 4 weeks after heavy rains, and the soil remains wet for extended periods. This soil is flooded one or more times in 4 to 10 years.

This soil is used mostly for range. A few small areas are planted to perennial grasses such as coastal bermudagrass. Capability unit VIw-2, dryland; pasture and hayland group 7E; Lakebed range site.

Topia Series

The Topia series consists of moderately deep, well-drained, nearly level to gently sloping soils. These soils are on uplands in valleys or on benches below steeper soils on hills. They formed mainly in clayey material.

In a representative profile the surface layer is dark-brown clay about 5 inches thick. The next layer is 33 inches thick. In the upper 14 inches it is dark reddish

-brown clay. In the next 7 inches it is very firm, reddish-brown clay and a few limestone fragments. In the lower 12 inches it is firm, reddish-brown clay and about 50 percent limestone fragments. The underlying material is light brownish-gray and very pale brown, weakly consolidated limestone to a depth of 48 inches.

Permeability is very slow, and the available water capacity is high. When dry, these soils have cracks 20 inches or more deep. Water enters the soils readily when they are dry and cracked, but it enters very slowly when the soils are wet and the cracks close.

Nearly all the acreage is used for range and wildlife habitat. A few scattered areas are in small grain used for grazing as well as for feed. Also grown is a small acreage of grain sorghum and improved pasture.

Representative profile of Topia clay, 0 to 2 percent slopes, in native range, 21.8 miles north on Farm Road 462 from its junction with U.S. Highway 90, 0.6 mile west, and 3.8 miles north on county road to entrance of Milton Batot Ranch; 0.2 mile south of ranch headquarters and 50 feet west of pasture road:

A1—0 to 5 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) when moist; moderate, fine and medium, subangular blocky structure; very hard, firm, very sticky and plastic; many fine roots; few fine pores and old root channels; neutral; clear, smooth boundary.

B21t—5 to 12 inches, dark reddish-brown (5YR 3/2) clay, dark reddish brown (5YR 3/2) when moist; moderate, fine and very fine, angular blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots, mainly between peds; distinct clay films on faces of peds; dark organic stains on some peds; few streaks of darker material; neutral; gradual, wavy boundary.

B22t—12 to 19 inches, dark reddish-brown (5YR 3/3) clay, dark red-dish brown (5YR 3/3) when moist; moderate, fine and medium, angular blocky structure; very hard, very firm, sticky and plastic; few fine roots, mainly between peds; shiny clay films on faces of peds; about 2 percent, by volume, is limestone pebbles as large as 2 inches; mildly alkaline; gradual, wavy boundary.

B23t—19 to 26 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; moderate, fine and very fine, angular blocky structure; very hard, very firm, sticky and plastic; few fine roots between peds; patchy clay films on faces of peds; about 3 percent, by volume, is limestone pebbles; few, fine, soft lumps or masses of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B24t—26 to 38 inches, reddish-brown (5YR 4/4) clay; dark reddish brown (5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few roots; about 50 percent, by volume, is weakly cemented limestone fragments and calcium carbonate concretions; calcareous; moderately alkaline; abrupt, wavy boundary.

C—38 to 48 inches, light brownish-gray (10YR 6/2) and very pale brown (10YR 7/4) weakly consolidated limestone; a few streaks and splotches of reddish-yellow clay.

The thickness of the solum and the depth of limestone range from 21 to 40 inches. Coarse fragments range from a few to 15 percent in the upper part of the solum.

The A horizon is 4 to 10 inches thick. It is dark reddish brown, brown, dark brown or very dark gray. Reaction ranges from mildly alkaline to slightly acid but is typically neutral.

The B2t horizon is dark brown, dark reddish brown, dark reddish gray, or reddish brown. Reaction ranges from mildly alkaline to slightly acid in the upper part and is mildly alkaline or moderately alkaline in the lower part.

The C horizon is interbedded chalk, marl, weakly consolidated limestone, or hard limestone.

TpB—Topia clay, 0 to 2 percent slopes. This nearly level to gently sloping soil is on uplands. It is mainly in irregularly shaped areas of about 10 to 100 acres.

Included with this soil in mapping are small areas of similar soils that are more than 40 inches deep to limestone, are underlain by hard limestone, are lighter colored or darker colored, or are slightly less clayey. Also included are small areas of Kavett, Pratley, and Speck soils.

Only a few small areas of this soil are cultivated, but the soil should not be tilled when it is too wet or too dry.

Management needs for cultivated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. Terraces and contour tillage help to control erosion, conserve moisture, and maintain tilth and productivity. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-10, dryland, and IIIe-9, irrigated; pasture and hayland group 7A; Deep Redland range site.

Valco Series

The Valco series consists of shallow, well-drained, nearly level to gently sloping soils on uplands. These soils formed in thick beds of loamy, calcareous material weathered from limestone.

In a representative profile the surface layer is clay loam about 16 inches thick. It is grayish brown in the upper 6 inches and dark grayish brown below that. It rests on a layer of strongly cemented caliche about 3 inches thick. Below that is weakly cemented caliche to a depth of 40 inches.

Permeability is moderate above the strongly cemented caliche layer and is slow in the caliche layer. The available water capacity is low.

Valco soils are used mainly for range and wildlife habitat, but some areas are used for crops, mainly small grains and introduced grasses. A small acreage is used for grain sorghum. Some small areas are irrigated. Road materials are mined from open pits in some places.

Representative profile of Valco clay loam, 0 to 2 percent slopes, in native pasture, 6.1 miles north on Farm Road 471 from its junction with U.S. Highway 90, 1.7 miles west and north on county road across Medina River to gate, then 0.2 mile east on private road and 100 feet south:

A11—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky and granular structure; hard, friable; many fine roots; few fine pores; few worm casts and insect tunnels; thin crust of lighter colored material on surface; few snail shell fragments; few fine calcium carbonate concretions; few weakly cemented limestone fragments as large as 1 inch; calcareous; moderately alkaline; clear, smooth boundary.

A12—6 to 14 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; common fine roots; common pores and old root channels; few worm casts and insect tunnels; few visible threads and fine concretions of calcium carbonate; few angular limestone fragments as large as 2 inches; calcareous; moderately alkaline; clear, smooth boundary.

A13—14 to 16 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; about 70 percent is strongly cemented caliche fragments as large as 4 inches; calcareous; moderately alkaline; abrupt, smooth boundary.

C1cam—16 to 19 inches, white (10YR 8/2) strongly cemented caliche that is weakly laminar in the upper part; few cracks and crevices filled with soil material from the A horizon; calcareous; moderately alkaline; abrupt, smooth boundary.

C2ca—19 to 40 inches, white (10YR 8/2) weakly cemented caliche; a few rounded limestone and chert pebbles.

The thickness of the solum and the depth to a layer of cemented caliche range from 10 to 20 inches. Coarse fragments range from a few to about 15 percent in the upper part of the solum and from a few to as much as 80 percent in the lower 2 to 5 inches of the solum.

The A horizon is dark brown, brown, dark grayish brown, or very dark grayish brown. Many profiles lack the A13 horizon.

The upper part of the C1cam horizon is laminar in most places. The C2ca horizon ranges from white to very pale brown, weakly cemented limestone or caliche to pinkish, limy soil material of about clay loam texture.

VaB—Valco clay loam, 0 to 2 percent slopes. This nearly level or gently sloping soil is mainly in rounded to irregularly shaped areas. The areas range from 10 to 250 acres but average about 40 acres.

Included with this soil in mapping are small areas of soils that have a gravelly surface layer, are more clayey, or are underlain by weakly cemented caliche. Also included are patches of Castroville, Knippa, Olmos, and Rehm soils.

Runoff is medium, and the hazard of erosion is moderate.

Management needs for both dryfarmed and irrigated fields include using crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IVs-3, dryland, and IIIe-2, irrigated; pasture and hayland group 13A; Shallow, Rio Grande Plain, range site.

Victoria Series

The Victoria series consists of deep, somewhat poorly drained, nearly level soils on outwash plains and stream terraces. These soils formed in calcareous, clayey material.

In a representative profile the surface layer is clay about 40 inches thick. It is dark gray in the upper 7 inches and very dark gray below. The next layer is gray clay about 20 inches thick. The underlying material is very pale brown clay to a depth of 70 inches.

Permeability is very slow, and the available water capacity is high. There are scattered small depressions in areas that have never been plowed. These soils crack when dry. The cracks are about ½ inch to 2 inches wide at the surface and penetrate several feet into the soil. Water enters the soils rapidly when the cracks are open, but it enters very slowly when the soils are wet and the cracks close.

Victoria soils are used mainly for crops. Much of the acreage used for crops is irrigated and used mainly for corn, grain sorghum, and small grain. A few vegetables and truck crops are also grown.

Representative profile of Victoria clay, 0 to 1 percent slopes, in a cultivated field, 8.6 miles east on U.S. Highway 90 from its junction with State Highway 173 in Hondo, then 3.3 miles north on county road and 125 feet west:

Ap—0 to 7 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, fine and very fine, subangular blocky and coarse granular structure; hard, firm; many fine roots; few scattered chert pebbles as large as 3 inches; few fine calcium carbonate concretions and snail shell fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

A12—7 to 16 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; moderate, fine, angular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; few fine calcium carbonate concretions .and snail shell fragments; prominent pressure faces on peds; calcareous; moderately alkaline; gradual, wavy boundary.

A13—16 to 40 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; coarse grooved slickensides form parallelepipeds that part to moderate, fine and very fine, angular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few fine and very fine calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

AC—40 to 60 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; common very dark gray (10YR 3/1) streaks along old closed cracks; coarse grooved slickensides and distinct parallelepipeds that part to moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine and very fine calcium carbonate concretions; few snail shell fragments; calcareous; moderately alkaline; gradual, wavy boundary.

C—60 to 70 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) when moist; common gray (10YR 5/1) streaks along old closed cracks; massive; extremely hard, extremely firm; common fine calcium carbonate concretions; calcareous; moderately alkaline.

The thickness of the solum ranges from 50 to 72 inches and varies within short distances because of the cyclic nature of the soil. When dry, these soils have cracks that extend from the surface to the C horizon. In some profiles there are a few coarse fragments of chert or limestone. In the A horizon electrical conductivity ranges from 0.5 to 5 millimhos per centimeter. In the AC and C horizons it ranges from 5 to 12 millimhos per centimeter. It is thinnest on the microridges and thickest in the microdepressions. It is dark gray or very dark gray. This horizon is moderately alkaline. It is mainly calcareous but is noncalcareous to a depth of about 12 inches in some microdepressions. The amplitude of waviness of the boundary between the A and the AC horizons ranges from about 20 to 40 inches.

The AC horizon is 18 to 30 inches thick. It is gray, grayish-brown, or light brownish-gray clay. It typically contains streaks of dark gray or very dark gray in closed or partly filled cracks.

The C horizon ranges from light gray to very pale brown. In this horizon, calcium carbonate in the form of soft lumps or cemented concretions and gypsum crystals or other salts range from a few to 5 percent, by volume.

VcA—Victoria clay, 0 to 1 percent slopes. This nearly level soil is on outwash plains and stream terraces. It is in broad, rounded to irregularly shaped areas. The areas range from 10 acres to more than 500 acres but average about 60 acres.

Included with this soil in mapping are small areas of Mercedes soils, mainly along small drainageways or channels that cross areas of this soil. Also included are small areas of Monteola soils, mainly on slope breaks next to soils at a higher position. Small patches of Castroville and Knippa soils are included in some areas.

Surface runoff is very slow, and the hazard of erosion is slight.

This soil is used mainly for crops and is suited to irrigation. The soil is somewhat difficult to till when it is too wet or too dry.

Management needs for both dryfarmed and irrigated fields include using fertilized crops that help protect the soil during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIs–2, dryland, and IIs–4, irrigated; pasture and hayland group 7A; Clay Flat range site.

Webb Series

The Webb series consists of deep, well-drained, nearly level to gently sloping soils on uplands. These soils formed in loamy material and weakly consolidated sandstone.

In a representative profile the surface layer is brown fine sandy loam about 12 inches thick. The next layer extends to a depth of 78 inches. In the upper 7 inches it is reddish-brown sandy clay loam. In the next 24 inches it is red sandy clay. In the lowermost 15 inches it is yellowish-red sandy clay loam. Below this to a depth of 78 inches, is reddish yellow sandy clay loam.

Permeability is moderately slow, and the available water capacity is high.

Webb soils are used for crops and range. The main dryfarmed crops are grain, sorghum, small grains, peanuts, and improved bermudagrass. These crops and vegetables and some other truck crops are grown under irrigation.

Representative profile of Webb fine sandy loam, 0 to 1 percent slopes, in range, 11.9 miles south on Farm Road 462 from its junction with U.S. Highway 90 in Hondo, 1.3 miles east on county road, 200 feet north of cattle guard, and 100 feet west of private road:

A1—0 to 12 inches, brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable; many fine roots; slightly acid; clear, smooth boundary.

B1t—12 to 19 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; few roots; many fine pores and old root channels; few clay films on surfaces of peds and in pores; slightly acid; clear, smooth boundary.

B21t—19 to 29 inches, red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) when moist; weak, medium, prismatic structure parting to moderate, fine and medium, angular blocky; very hard, firm; few roots; few fine pores and old root channels; few clay films on peds; slightly acid; gradual, smooth boundary.

B22t—29 to 43 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) when moist; moderate, medium, prismatic structure parting to strong, medium, angular blocky; very hard, very firm; few roots mainly between peds; few very fine pores and old root channels; common distinct clay films on peds; few dark stains on peds; neutral; clear, wavy boundary.

B31tca—43 to 58 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate, fine and medium, subangular blocky structure; hard, friable; few fine pores; few clay films on peds; about 10 percent, by volume, is soft masses and a few strongly cemented concretions of calcium carbonate; few fine, yellowish-brown and reddish-brown sandstone fragments; few dark stains and old channels partly filled with darker material; calcareous; moderately alkaline; clear, wavy boundary.

B32tca—58 to 78 inches, reddish-yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) when moist; massive; hard, friable; about 8 percent, by volume, is soft masses and a few strongly cemented concretions of calcium carbonate; few, fine, yellowish-brown and reddish-brown sandstone fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

The A horizon is 7 to 20 inches thick. It is reddish brown, yellowish- red, or brown. The A and B1t horizons range from medium acid to neutral.

The B1t horizon is 4 to 7 inches thick. It has the same colors as the A horizon. It is sandy clay loam or fine sandy loam. Some profiles lack this horizon.

The B2t horizon is 10 to 35 inches thick. It is red to yellowish-red sandy clay, clay, or clay loam. It ranges from slightly acid to mildly alkaline.

The B3t horizon is 16 to 40 inches thick. It is red, yellowish red, reddish yellow, or reddish brown and is sandy clay loam or fine sandy loam. This horizon is mildly alkaline or moderately alkaline and is typically calcareous.

WbA—Webb fine sandy loam, 0 to 1 percent slopes. This nearly level soil is in small drainageways or on smooth uplands. Most areas of this soil are elongated and average about 25 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Duval, Lacoste, and Miguel soils. Also included are soils that are similar to Webb soils but have sandstone or caliche within 40 inches of the surface or have many mottles below the surface layer.

Surface runoff is slow. The hazards of water erosion and soil blowing are slight.

Management needs on both dryfarmed and irrigated fields include using fertilized crops that help protect the soil from soil blowing and water erosion during their growth and that furnish sufficient residue to protect and improve the soil between growing seasons. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, weeping lovegrass, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIc–3, dryland, and I–5 irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

WbB—Webb fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is on uplands next to small drainageways or on breaks between more level soils and soils at a higher or lower position. It is in irregularly shaped areas that range from 10 to 220 acres.

The surface layer is reddish-brown fine sandy loam about 10 inches thick. The next layer is yellowish-red sandy clay loam about 6 inches thick. The layer below that is 25 inches thick; it is very hard, red and yellowish-red sandy clay that contains a few calcium carbonate lumps and concretions, mainly in the lower part. Reddish-yellow sandy clay loam is below a depth of 60 inches.

Included with this soil in mapping are small areas of Duval, Hanis, Lacoste, and Miguel soils. Also included is a soil that is similar to Webb soils but has sandstone or caliche within 40 inches of the surface.

This soil is used for crops. and range. Surface runoff is medium. The hazards of water erosion and soil blowing are moderate.

Management needs for cultivated fields include fertilization and using crops that help protect the soil during their growth and that furnish sufficient residue to conserve moisture, maintain tilth and productivity, and protect and improve the soil between

growing seasons. Terraces and contour tillage help to control erosion and conserve moisture. In many areas grassed waterways help to carry excess water off the land and prevent erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-7, dryland, and IIe-5, irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

WbC—Webb fine sandy loam, 3 to 5 percent slopes. This gently sloping soil is on uplands. It is in irregularly shaped areas of 10 to 14 acres.

The surface layer is brown fine sandy loam about 8 inches thick. The next layer extends to a depth of 48 inches. In the upper 6 inches it is reddish-brown sandy clay loam. In the next 24 inches it is red sandy clay. In the lower 10 inches it is yellowish-red sandy clay loam and a few chert pebbles. Below a depth of 48 inches is reddish-yellow sandy clay loam that grades to weakly consolidated sandstone.

Included with this soil in mapping are small areas of Duval, Hanis, Lacoste, and Hindes soils. Also included are a few spots where sheet erosion has removed 50 to 75 percent of the surface layer.

Surface runoff is medium. The hazards of soil blowing and water erosion are moderate.

This soil is used mostly for range, but a few areas are cultivated.

Management needs for cultivated fields include fertilization and using crops that help protect the soil in the growing season and that furnish sufficient residue to control soil blowing and protect and improve the soil between growing seasons. Striperopping also helps to control soil blowing. Terraces and contour tillage help to control erosion, conserve moisture, and maintain tilth and productivity. In many places grassed waterways are needed to safely carry excess water off the land and help prevent erosion. A well-designed irrigation system and proper water management are needed on irrigated land.

Suitable pasture and hay plants include improved bermudagrass, Kleberg bluestem, kleingrass, blue panicum, buffelgrass, and other improved pasture grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-11, dryland, and IIIe-4, irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

Wilco Series

The Wilco series consists of deep, well-drained, nearly level to gently sloping soils on uplands. These soils formed in loamy material several feet thick.

In a representative profile the surface layer is loamy fine sand about 14 inches thick. It is pale-brown in the upper 6 inches and brown below. The next layer is 46 inches thick. In the upper 16 inches it is yellowish-brown sandy clay loam that has yellowish-red mottles. In the next 18 inches it is yellowish-brown sandy clay that has yellowish-red, red, and light olive-brown mottles. In the lower 12 inches it is brownish-yellow sandy clay loam and a few soft masses of calcium carbonate. Below this is faintly mottled, reddish-yellow sandy clay loam about 12 inches thick; it contains a few soft masses and cemented concretions of calcium carbonate. The underlying material, to a depth of 96 inches, is reddish-yellow sandy clay loam and a few soft masses and concretions of calcium carbonate.

Permeability is slow, and the available water capacity is medium.

Wilco soils are used mainly for crops, and a small acreage is irrigated. A few areas remain in native range.

Representative profile of Wilco loamy fine sand, 0 to 3 percent slopes, in a cultivated field, 2.4 miles east on Farm Road 2200 from its junction with Farm Road 462 in Yancey, and 300 feet south on field road:

Ap—0 to 6 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) when moist; loose, very friable; many fine roots; medium acid; clear, smooth boundary.

A1—6 to 14 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) when moist; soft, very friable; many fine roots; medium acid; abrupt, wavy boundary.

B21t—14 to 30 inches, yellowish-brown (10YR 5/4) sandy clay, dark yellowish brown (10YR 4/4) when moist; many, medium and coarse, yellowish-red (5YR 5/6) mottles; moderate, fine, blocky structure; very hard, very firm; few fine roots and pores; clay films on peds; slightly acid; gradual, wavy boundary.

B22t—30 to 48 inches, yellowish-brown (10YR 5/6) sandy clay, slightly darker yellowish brown when moist; common, fine and medium, faint, yellowish-red (5YR 5/6) mottles and few, fine, distinct, red (2.5YR 4/6) and light olive-brown (2.5Y 5/6) mottles; moderate, fine, blocky structure; very hard, very firm; few fine roots and pores; clay films and few dark stains on peds; slightly acid; gradual, wavy boundary.

B3t—48 to 60 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish-brown (10YR 5/6) when moist; few, medium, faint, strong-brown (7.5YR 5/6) and light olive-brown (2.5Y 5/6) mottles; weak, fine and medium, blocky structure; hard, friable; few, fine, black-brown concretions; few, fine, soft masses of calcium carbonate; matrix is noncalcareous; moderately alkaline; clear, smooth boundary.

C1ca—60 to 72 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) when moist; few, fine, faint, yellowish-red (5YR 5/6) mottles; massive; hard, friable; about 5 percent, by volume, is soft masses and fine concretions of calcium carbonate; few, fine, black-brown concretions; calcareous; moderately alkaline; gradual, smooth boundary.

C2—72 to 96 inches, reddish-yellow (7.5 YR 6/8) sandy clay loam, strong brown (7.5YR 5/6) when moist; few, fine, faint, yellowish-red mottles; massive; hard, friable; about 15 percent chert pebbles, mainly smaller than 2 inches but ranging to 3 inches; few calcium carbonate concretions; calcareous; moderately alkaline.

The A horizon is 10 to 18 inches thick. It ranges from pale brown or brown to yellowish brown.

The Bt horizon is 25 to 55 inches thick. It is brownish-yellow, pale-brown, brown, light yellowish-brown, strong brown, to yellowish-brown sandy clay loam to clay. It has mottles in shades of red, yellow, brown, and olive.

The C horizon ranges from very pale brown to reddish-yellow fine sandy loam to sandy clay loam. It is mildly alkaline or moderately alkaline, and some areas are calcareous. Mottles are less distinct and less numerous in this horizon, and in some places this horizon lacks mottles. In some profiles there is as much as 15 percent, by volume, water-rounded chert pebbles below a depth of 40 inches.

WoB—Wilco loamy fine sand, 0 to 3 percent slopes. This nearly level to gently sloping soil is in oblong or irregularly shaped areas that are typically about 15 acres.

Included with this soil in mapping are small areas of Miguel, Nueces, Poth, and Webb soils, mainly at the lower end of slopes or in shallow depressions.

Water enters into the surface of this soil rapidly, but it moves slowly below the surface layer. Surface runoff is slow. The hazard of soil blowing is high, and the hazard of water erosion is slight.

Management needs for cultivated fields include using crops that help protect the soil from soil blowing and water erosion during the growing season and that furnish sufficient residue to protect and improve the soil between growing seasons. Fertilization and using plant residue help to conserve moisture and maintain tilth and productivity. A well-designed irrigation system and proper water management are needed on irrigated land. Sprinkler irrigation systems are best suited to this soil.

Suitable pasture and hay plants are improved bermudagrass, weeping lovegrass, buffelgrass, and other introduced grasses. Management needs for pasture include fertilization, weed control, grazing control, and rotation grazing. The main management need on range is the control of soil blowing. On hayland, proper timing and methods of harvesting the hay are important. Capability units IIIe-9, dryland, and IIIe-10, irrigated; pasture and hayland group 9A; Sandy range site.

Yologo Series

The Yologo series consists of very shallow to shallow, well-drained, gently sloping to sloping and undulating soils on uplands. These soils formed in gravelly loamy material.

In a representative profile the surface layer, about 4 inches thick, is reddish-brown gravelly loam and about 20 percent water-rounded pebbles. The next layer, which is 7 inches thick, is brown very gravelly clay loam and about 70 percent water-rounded chert pebbles. The underlying material is whitish, indurated caliche that is somewhat platy and laminar and 2 inches thick. Beneath this is whitish caliche, to a depth of 60 inches.

Permeability is moderate above the layer of indurated caliche and is slow in the indurated caliche. The available water capacity is very low.

The entire acreage is used for range or wildlife habitat. In some areas the caliche is mined and used for road construction.

Representative profile of Yologo gravelly loam, in an area of Yologo association, undulating, 3.1 miles east of D'Hanis on U.S. Highway 90 and 7.7 miles south on county road; in the northeastern corner of Richardson Ranch:

A1—0 to 4 inches, reddish-brown (5YR 4/3) gravelly loam, dark red-dish brown (5YR 3/2) when moist; weak, fine, subangular blocky structure; hard, friable; many fine roots; about 20 percent water-rounded chert pebbles and gravel; neutral; clear, smooth boundary.

B2t—4 to 11 inches, brown (7.5YR 4/2) very gravelly clay loam, dark brown (7.5YR 3/2) when moist; moderate, fine and very fine, blocky structure; hard, firm; many fine roots and pores; about 70 percent water-rounded chert pebbles and gravel; few cobbles; mildly alkaline; abrupt, wavy boundary.

IIC1cam—11 to 13 inches, indurated whitish caliche plates; laminar in upper part; about 10 percent soil material between plates; calcareous; moderately alkaline; abrupt boundary.

IIC2ca—13 to 60 inches, whitish caliche of about clay loam texture; massive; hard, friable; few streaks and pockets of darker soil material, mainly in upper part; calcareous; moderately alkaline.

The solum is 7 to 20 inches thick and varies within short distances. The B horizon contains 35 to 80 percent, by volume, water-rounded chert pebbles.

The A horizon, 2 to 14 inches thick, is dark grayish-brown to reddish-brown loam to sandy clay loam. The A and B2t horizons range from slightly acid to mildly alkaline. The B2t horizon, about 5 to 12 inches thick, is brown or dark-brown to reddish-brown sandy clay loam to clay loam. The IIC1cam horizon is ¼ inch to 6 inches thick. The IIC2ca horizon is weakly cemented or soft caliche, and it has few to common chert pebbles in some profiles.

YOD—Yologo association, undulating. This association consists of gravelly loams on ridges. The areas are mainly rounded to irregularly shaped and cover about 50 to 150 acres. Slopes range from 1 to 8 percent but are mainly about 2 to 5 percent. The Yologo gravelly loam in this association has the profile described as representative of the series (fig. 14).

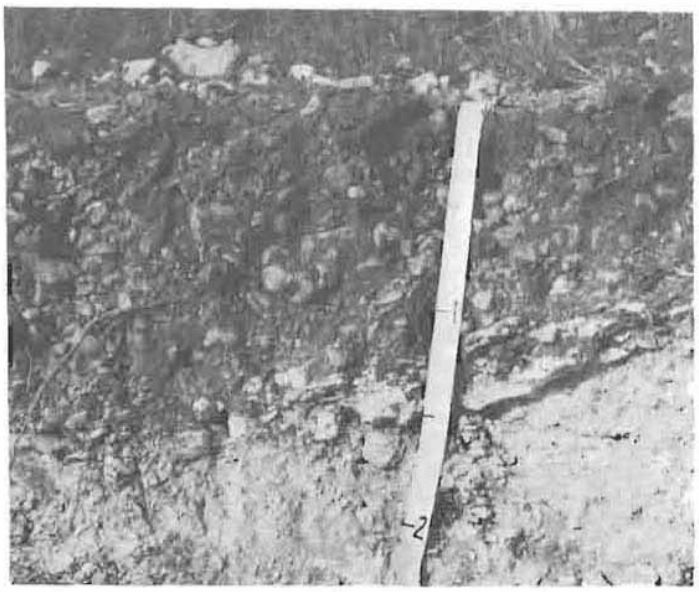

Figure 14.—Profile of Yologo gravelly loam in a road cut.

The composition of this mapping unit is more variable than that of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated uses of the soils. This association is about 45 percent Yologo soils, 15 percent similar soils that lack the layer of indurated caliche, 15 percent Hindes soils, 10 percent Olmos soils, 5 percent Lacoste soils, and 10 percent Caid, Devine, Duval, Hanis, and Webb soils. These soils were not mapped separately because their use and management are similar.

Surface runoff is medium, and the hazard of water erosion is moderate. The available water capacity is very low. Erosion is active in areas of range where there is no vegetation to protect the soil. The coarse fragments on the surface and in the soils help to reduce erosion and slow runoff by increasing water intake and reducing evaporation.

These soils are not suited to crops because of the large amount of coarse fragments and the shallowness. They are best suited to range and wildlife habitat. Capability unit VIIs-5, dryland; not in a pasture and hayland group; Gravelly Ridge range site.

YsD—Yologo and Hindes soils, 1 to 8 percent slopes. This undifferentiated group consists of gently sloping to sloping and undulating soils on uplands. It is mainly in rounded to irregularly shaped areas that range from about 5 to 30 acres. Small areas of this mapping unit are within large areas of similar soils. Slopes range from about 1 to 8 percent but are mainly less than 4 percent.

This mapping unit is about 40 percent Yologo soils, 25 percent Hindes soils, 15 percent soils that are similar to Yologo soils but lack the layer of indurated caliche,

and 10 percent Olmos soils. The remaining 10 percent consists of Caid, Devine, Duval, Hanis, Lacoste, and Webb soils. Mapped areas can be mostly Yologo soils or mostly Hindes soils.

The Yologo soils have a surface layer of reddish-brown gravelly loam about 7 inches thick. The next layer is dark-brown, firm very gravelly clay loam about 6 inches thick. The underlying material is caliche that is strongly cemented in the upper few inches and weakly cemented below that.

The Hindes soils have a surface layer of reddish-brown gravelly sandy clay loam about 9 inches thick. The next layer is dark reddish-brown very gravelly clay about 25 inches thick. Below that, to a depth of about 60 inches, is soft caliche and a few chert pebbles.

These soils are well drained. Permeability is moderate above the caliche layers in the Yologo soils and is moderately slow in the Hindes soils. The available water capacity is low to very low. Runoff is medium. The hazard of erosion is moderate.

This mapping unit is used for range or wildlife habitat. Yologo part in capability unit VIIs-5, dryland, and Hindes part in capability unit VIs-3, dryland; not in a pasture and hayland group; Gravelly Ridge range site.

Use and Management of the Soils

The soils of Medina County are used mainly for dryfarmed and irrigated crops, dryfarmed and irrigated pasture and hayland, range, wildlife habitat, and recreation purposes. They are also used for other projects that require basic information about the soils. These projects include dwellings, local roads and streets, sanitary landfills, sewage systems, airfields, feedlots, and other structures.

In the following pages, the use and management of the soils for crops is discussed and the system of capability classification adopted by the Soil Conservation Service is explained. The use and management of the soils for pasture and hayland is also discussed and the pasture and hayland groups are described. Predicted yields of principal crops and pasture plants are given. Next, the soils are grouped according to the kind and amount of forage they can produce if used for range. The use of the soils for wildlife habitat and for recreation is then discussed. Information for engineering uses of soils is given, mainly in tables.

Use of the Soils for Crops

In Medina County about 168,500 acres are used for dryfarmed crops and 32,000 acres for irrigated crops. The trend in the past 10 years has been toward a slight decrease in dryfarmed crops and a slight increase in irrigated crops. The major dryfarmed crops are grain sorghum, forage sorghum, and small grain. The major irrigated crops are grain sorghum, peanuts, corn, and truck crops.

Management of the soils for dryfarmed crops

Because of the limited rainfall and the high evaporation and transpiration rates in Medina County, conservation of moisture is a major objective of management. Maintenance of fertility and control of erosion are also important.

The conservation practices needed on all dryfarmed fields are conservation cropping systems, crop residue management, minimum tillage, and fertilization. On many of the nearly level soils, contour farming alone or with terracing helps hold the rainfall on the land until it can be absorbed by the soil. On the steeper soils, contour farming, field terracing, diversion terracing, and grassed waterways are needed to control erosion as well as to conserve water.

The crops generally grown in the county fit easily into a conservation cropping system. If the fertility is adequate, they produce enough residue to return to the soil to maintain the tilth.

A good litter of crop residue left on the soil surface protects the soil against packing by rain and machinery, reduces crusting, increases water intake, decreases runoff and erosion, and reduces evaporation. It also improves the tilth of the surface layer. Crop residue should not be burned or removed by grazing.

The soil should be tilled enough to prepare a good seedbed and to control weeds. Excessive tillage and tilling when the soil is wet damages the soil structure and causes plowpans to form. Poor soil structure and plowpans slow water intake and, consequently, increase runoff and erosion. Poor structure reduces the air space in the soil. Plowpans restrict root growth.

Although the soils in Medina County respond to fertilizer, applying fertilizer may not be economical in dry years. Generally, fertilizer should be applied during the growing season when the top 2 feet of the soil are at field capacity but the surface layer is dry enough to be tilled. For small grain, fertilizer can be applied from planting time through February; for grain sorghum, from February 1 through April 30; and for forage sorghum, through September 15.

Fertilizer should be applied according to the results of a chemical analysis of the soil. The soils generally need nitrogen and phosphorus in a ratio of about 1 to 1 for grain oats and maize, a ratio of about 2 to 1 for grazed oats, and a ratio of 3 to 1 for forage sorghum.

Terraces help control erosion. They can be designed to reduce runoff and thus conserve moisture or divert water from fields. Those designed to reduce runoff should be used along with contour farming. Parallel terraces permit farming on the approximate contour without the inconvenience of having short rows between terraces. Thus, the efficiency of large equipment is increased.

Contour farming also reduces runoff, conserves moisture, and helps control erosion. Contour farming should be used with terraces where the slopes are 1 percent or more. Contour farming alone can be effective in nearly level soils.

Grassed waterways are needed with some terrace systems or to carry water across fields. They should be built according to engineering specification. In most cases they need to be seeded with a perennial grass. Depending on the soil, Coastal bermudagrass or King Ranch bluestem is well suited. Once the grass is established, it can be grazed or harvested for hay or seed.

Management of the soils for irrigated crops

Approximately 32,000 acres of cultivated fields are irrigated in Medina County. The large areas of nearly level soils are well suited to irrigation farming. Good quality water is pumped mainly from Medina Lake and from the following geologic formations: Edwards Limestone, Carrizo Sand, and Leona Formation. The water is applied mainly by surface gravity and sprinkler systems.

The main irrigated crops are vegetables, corn, grain sorghum, peanuts, and watermelons. The principal vegetables are cabbages, carrots, peppers (fig. 15), and onions. Improved bermudagrass and small grain for grazing are also irrigated.

Management of irrigated fields should include a conservation cropping system, fertilization, management of crop residue to maintain soil tilth, and weed and insect control.

Management of the irrigation water is also important. The required amount of water should be applied evenly to all parts of the field when the crop needs it. For this to be done efficiently, an engineering design must be used to lay out and construct the system and to apply the water. In many places, earth-moving equipment must be used to level or grade the land so that water can be applied evenly.

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops, the risk of damage when they are farmed, and the way the soils respond to

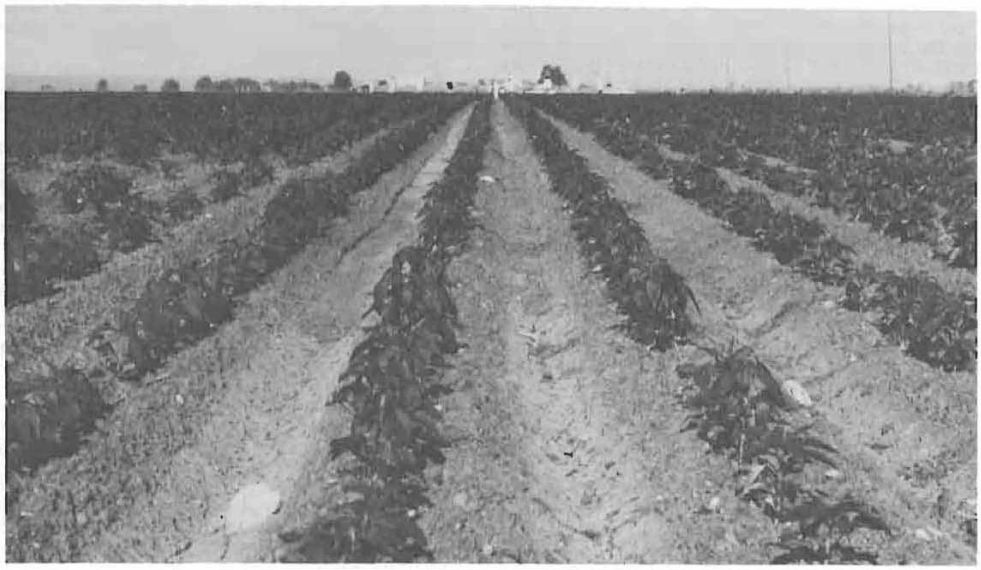

Figure 15.—Bell peppers in an irrigated field on Castroville clay loam, 0 to 1 percent slopes.

treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification system can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclass indicates major kinds of limitations within the class. The subclass is indicated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIe. The letter "e" shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; "w" means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); "s" shows that the soil is limited mainly because it is shallow, droughty, or stony; and "c" indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have a few or no limitations. Class V can contain, at the most, only subclasses w, s, and c, because the soils are subject to little or no erosion although they have other limitations that restrict their use largely to pasture, range, or wildlife habitat.

Subclasses are divided into groups called capability units. These are groups of soils that are suited to the same crops and pasture plants, that require about the same management, and that have similar productivity and other responses to management. Capability units are identified by numbers assigned locally, for example, IIe–1 or IIIs–3.

Class I. Soils that have few limitations that restrict their use.

(No subclasses).

Capability unit I-1, irrigated. Deep, nearly level, moderately slowly permeable clay loams and sandy clay loams on uplands.

Capability unit I-2, irrigated. Deep, nearly level, moderately permeable clay loams and sandy clay loams on uplands.

Capability unit I-3, irrigated. Deep, nearly level, moderately slowly permeable clay loams on bottom land.

Capability unit I-4, irrigated. Deep, nearly level, moderately permeable fine sandy loams on uplands.

Capability unit I-5, irrigated. Deep, nearly level, very slowly to moderately slowly permeable fine sandy loams on uplands.

Class II. Soils that have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

Capability unit IIe-1, dryland. Deep, gently sloping, moderately slowly permeable clay loams and sandy clay loams on uplands.

Capability unit IIe-1, dryland. Deep, gently sloping, moderately slowly permeable clay loams and sandy clay loams on uplands.

Capability unit IIe-2, irrigated. Deep, gently sloping, moderately permeable loams, sandy clay loams, and clay loams on uplands.

Capability unit IIe-2, dryland. Deep, gently sloping, moderately to moderately slowly permeable clay loams and clays on uplands.

Capability unit IIe-3, irrigated. Deep, gently sloping, moderately permeable fine sandy loams on uplands.

Capability unit IIe-3, dryland. Deep, nearly level to gently sloping, very slowly permeable fine sandy loams on uplands.

Capability unit IIe-4, irrigated. Moderately deep to deep, nearly level to gently sloping, moderately slowly permeable clays on uplands.

Capability unit IIe-5, irrigated. Deep, gently sloping, moderately slowly permeable fine sandy loams on uplands.

Subclass IIs. Soils that have moderate limitations because of soil conditions, such as excess lime or adverse permeability.

Capability unit IIs-1, irrigated. Deep, nearly level, moderately permeable loams on uplands.

Capability unit IIs-1, dryland. Deep, nearly level, moderately slowly permeable clays on uplands.

Capability unit IIs-2, irrigated. Deep, nearly level, moderately slowly permeable clays on uplands.

Capability unit IIs-2, dryland. Deep, nearly level, very slowly permeable clays on uplands.

Capability unit IIs-3, irrigated. Deep, nearly level, very slowly permeable fine sandy loams on uplands.

Capability unit IIs-4, irrigated. Deep, nearly level, very slowly permeable clays on uplands.

Subclass IIc. Soils that have limitations caused by the dry climate.

Capability unit IIc-1, dryland. Deep, nearly level, moderately slowly permeable clay loams and sandy clay loams on uplands.

Capability unit IIc-2, dryland. Deep, nearly level, moderately permeable clay loams on uplands.

Capability unit IIc-3, dryland. Deep, nearly level, moderately slowly permeable clay loams on bottom land.

Class III. Soils that have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils subject to severe erosion if they are not protected.

Capability unit IIIe-1, irrigated. Moderately deep to deep, gently sloping, moderately to moderately slowly permeable silty clays and sandy clay loams on uplands.

Capability unit IIIe-1, dryland. Deep, gently sloping, moderately permeable loams on uplands.

Capability unit IIIe-2, irrigated. Shallow, nearly level to gently sloping and gently undulating, moderately to very slowly permeable clay loams, silty clays, and clays on uplands.

Capability unit IIIe-2, dryland. Moderately deep to deep, gently sloping, moderately to moderately slowly permeable clays, silty clays, and sandy clay loams on uplands.

Capability unit IIIe-3, irrigated. Deep, nearly level to gently sloping, moderately permeable loamy fine sands on uplands.

Capability unit IIIe-3, dryland. Shallow, gently sloping and gently undulating, moderately slowly to very slowly permeable clays and silty clays on uplands.

Capability unit IIIe-4, irrigated. Deep, gently sloping, moderately slowly permeable fine sandy loams on uplands.

Capability unit IIIe-4, dryland. Deep, gently sloping, moderately permeable fine sandy loams on uplands.

Capability unit IIIe-5, irrigated. Shallow, gently sloping, moderately permeable fine sandy loams on uplands.

Capability unit IIIe-5, dryland. Deep, nearly level to gently sloping, moderately to moderately slowly permeable loamy fine sands and fine sands on uplands.

Capability unit IIIe-6, irrigated. Deep, gently sloping, very slowly permeable clays and gravelly clays on uplands.

Capability unit IIIe-6, dryland. Deep, gently sloping, very slowly permeable clays on uplands.

Capability unit IIIe-7, irrigated. Deep, gently sloping, moderately permeable clay loams on uplands.

Capability unit IIIe-7, dryland. Deep, gently sloping, moderately slowly to very slowly permeable fine sandy loams on uplands.

Capability unit IIIe-8, irrigated. Deep, gently sloping, very slowly permeable fine sandy loams on uplands.

Capability unit IIIe-8, dryland. Deep, gently sloping, very slowly permeable gravelly clays on uplands.

Capability unit IIIe-9, irrigated. Moderately deep, nearly level to gently sloping, very slowly permeable clays on uplands.

Capability unit IIIe–9, dryland. Deep, nearly level to gently sloping, slowly permeable loamy fine sands on uplands.

Capability unit IIIe–10, irrigated. Deep, nearly level to gently sloping, slowly permeable loamy fine sands on uplands.

Capability unit IIIe–10, dryland. Moderately deep, nearly level to gently sloping, very slowly permeable clays on uplands.

Capability unit IIIe–11, dryland. Deep, gently sloping, moderately slowly permeable fine sandy loam on uplands.

Subclass IIIs. Soils that have severe limitations be-cause of soil conditions, such as droughtiness, excess lime, or adverse permeability.

Capability unit IIIs-1, irrigated. Deep, nearly level to gently sloping and gently undulating, moderately slowly to rapidly permeable fine sands on uplands.

Capability unit IIIs—1, dryland. Deep, nearly level, moderately permeable loams on uplands.

Capability unit IIIs-2, dryland. Deep, nearly level, very slowly permeable fine sandy loams on uplands.

Capability unit IIIs–3, dryland. Deep, gently undulating, moderately slowly permeable fine sands on uplands.

Class IV. Soils that have very severe limitations that re-duce the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are not protected.

Capability unit IVe–1, dryland. Deep, gently sloping, moderately permeable sandy clay loams on uplands.

Capability unit IVe-2, dryland. Shallow to deep, gently sloping, moderately permeable clay loams and fine sandy loams on uplands.

Subclass IVs. Soils that have very severe limitations because of soil conditions, such as shallowness, gravelly soil material, and adverse permeability.

Capability unit IVs–1, dryland. Deep, gently undulating, rapidly permeable fine sands on uplands.

Capability unit IVs–2, dryland. Moderately deep to deep, gently sloping to sloping and gently undulating to undulating, gravelly sandy loams and gravelly clay loams on uplands.

Capability unit IVs–3, dryland. Shallow, nearly level to gently sloping, moderately permeable clay loams on uplands.

Class V. Soils that are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife habitat.

Subclass Vw. Soils that have limitations caused by excess water.

Capability unit Vw—1, irrigated. Deep, nearly level, moderately slowly permeable clay loams on bottom land.

Capability unit Vw–1, dryland. Deep, nearly level, moderately slowly permeable clay loams on bottom land that is frequently flooded.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, or wildlife habitat.

Subclass VIe. Soils subject to very severe erosion if they are not protected.

Capability unit VIe–1, dryland. Moderately deep, strongly sloping to steep, very slowly permeable clays on uplands.

Subclass VIs. Soils that have very severe limitations because of soil conditions, such as gravelly soil material or shallowness.

Capability unit VIs–1, dryland. Very shallow to shallow, gently sloping to steep and undulating, moderately to moderately slowly permeable gravelly clay loams and loams on uplands.

Capability unit VIs–2, dryland. Shallow, gently sloping to sloping and undulating, slowly to moderately slowly permeable, clays and clay loams on uplands.

Capability unit VIs–3, dryland. Moderately deep to deep, gently sloping to sloping and undulating, moderately to moderately slowly permeable gravelly clay loams and gravelly sandy clay loams on uplands.
Capability unit VIs-4, dryland. Moderately deep, gently undulating, moderately slowly permeable gravelly silt loam soils on uplands.
Subclass VIw. Soils that have severe limitations because of excess water.
Capability unit VIw–1, dryland. Deep, nearly level to gently sloping, rapidly permeable loams on bottom land.
Capability unit VIw-2, dryland. Deep, nearly level, very slowly permeable clays in depressions on uplands.
Class VII. Soils that have very severe limitations that make them unsuited to cultivation and restrict their use largely to pasture, range, or wildlife habitat.
Subclass VIIs. Soils that have very severe limitations because of soil conditions, such as a shallow root zone.
Capability unit VIIs–1, dryland. Shallow, hilly to steep, moderately slowly permeable loams on uplands.
Capability unit VIIs-2, dryland. Shallow to very shallow, gently sloping to sloping and undulating, moderately permeable gravelly clay loams on uplands.
Capability unit VIIs–3, dryland. Shallow to very shallow, gently sloping to sloping and undulating to hilly, moderately slowly permeable cobbly clays on uplands.
Capability unit VIIs-4, dryland. Shallow to very shallow, steep cobbly clays on uplands.
Capability unit VIIs–5, dryland. Very shallow to shallow, slowly permeable, gravelly loams on uplands.
Class VIII. Soils and landforms that have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply or to esthetic purpose.
Subclass VIIIs. Landforms that are severely restricted by the lack of soil material.
Capability unit VIIIs–1, dryland. Hilly to steep areas of Rock outcrop.

Management of the Soils for Pasture and Hayland

Approximately 13,000 acres in Medina County are used for pasture and hayland; of this, about 4,900 acres are irrigated. The acreage is in perennial grasses and does not include the acreage on which annual crops are grown for livestock forage. The main grasses used for dryland pasture and hay are improved bermudagrass, blue panicum, buffelgrass, King Ranch bluestem, kleingrass, and Gordo bluestem. The main grass used for irrigated pasture and hay is improved bermudagrass.

Management and conservation practices that should be considered in a pasture or hayland program are the choice of adapted plants, fertilizing, rotation grazing, and weed control. Management of irrigation water is important, and some land leveling is needed on most irrigated soils.

Grasses adapted to growth in dryland areas are limited in number. Blue panicum, Coastal bermudagrass, kleingrass 75, Gordo bluestem, Kleberg bluestem, and King Ranch bluestem do well on clay and clay loam soils. King Ranch bluestem grows better on the Edwards Plateau than on the Rio Grande Plain. More blue panicum can be produced than any other grass. Weeping lovegrass, Coastal bermudagrass, buffelgrass, and blue panicum can be grown on the sandier soils in the county.

Many high producing grasses can be grown in irrigated pasture. The most important of these are Coastal bermudagrass, blue panicum, medio bluestem, Gordo bluestem, Bell rhodesgrass, kleingrass 75, johnsongrass, and weeping lovegrass. Coastal bermudagrass is the most versatile, and has a wide range of suitability.

In pasture, only one grass should be planted because mixing the different kinds makes management of the pasture difficult and causes the animals to overgraze the more palatable grasses and undergraze the others.

On dryfarmed pasture and hayland, the grasses generally respond to fertilizer, but the yield may not increase substantially. Fertilizer is important in establishing grass, especially in an old cultivated field where pasture is to be established.

On irrigated pasture and hayland, fertilizing is essential for economical production. Chemical analysis of the soils is the best guide to the need and application of fertilizer. Generally, however, the soils need nitrogen and phosphorus. Potassium is adequate in most places. Perennial grasses remove nitrogen and phosphoric acid in a ratio of about 4 to 1. Therefore, the amounts applied throughout the year should average 4 pounds of nitrogen for each pound of phosphoric acid. All of the phosphorus can be applied at one time, but the nitrogen needs to be applied in two to six applications. The amount used depends on the water available and the forage production desired.

On dryfarmed pasture, an excess of grass during the normal growing period insures that forage is available for grazing during droughty periods when the grass does not grow. If all the grass is grazed as rapidly as it grows, hay or other feed is needed in the dry periods. Hay is expensive; its use in large amounts is almost prohibitively expensive in a commercial cow-calf operation.

On irrigated land, grazing should be rotated and coordinated with the irrigating schedule. After they have been irrigated, most soils need a few days to dry out. If the soils are wet, grazing animals can cause the soil structure to break down.

On dryfarmed pasture, grazing does not have to be rotated because of low rainfall. The grazing of some grasses should be deferred if they are to produce a seed crop periodically.

On irrigated land, once the grass is established, the control of weeds normally is not a problem if the grass is properly harvested and fertilized. Grass that grows vigorously crowds out the weeds. On dryfarmed land, the control of weeds can be a problem, even on well managed pasture. Weeds can be mowed or killed with a hormone-type herbicide. The herbicide is usually more effective than mowing, and it does not damage the grass.

High production from irrigated pasture and hayland re-quires large amounts of water. For a 10-ton production per acre of Coastal bermudagrass hay, 30-acre-inches of water or more may be required. The fertility of the soil affects the efficiency of the water. The higher the fertility, the lower the water requirements. A rule-of-thumb is to plan for 5 inches of water for each ton of hay produced. The water can come from rainfall or irrigation. This rule also applies to forage for grazing, but is related to dry forage and not to tons of green material. Irrigation water should be applied evenly to all parts of the field.

Pasture and hayland groups

The soils of Medina County have been placed into pasture and hayland groups according to their suitability for the production of forage. The soils in each group are enough alike to be suited to the same grasses, to have similar limitations and hazards, to require similar management, and to have similar productivity and other responses to management. Thus, the pasture and hayland group is a convenient grouping of soils for making many statements about their management. The pasture and hayland groups are identified by numerals and upper case letters, for example 1C, which are part of a statewide system. The soils of Medina County do not fall into all of the groups in the system, therefore the numbers and letters are not consecutive.

The pasture and hayland group of each soil in the county is listed in the "Guide to Mapping Units" at the back of this survey.

Pasture and hayland group 1C.—This group consists of deep, nearly level clay loams that are moderately slowly permeable and have a high available water capacity. These soils are on bottom lands.

Pasture and hayland group 2A.—This group consists of deep, nearly level to gently sloping learns that are rapidly permeable and have a very low available water capacity. These soils are on bottom lands.

Pasture and hayland group 7A.—This group consists of deep to moderately deep, nearly level to gently sloping clays. These soils crack and take water rapidly when dry but expand and are very slowly permeable when wet. The available water capacity is high. These soils are on uplands.

Pasture and hayland group 7C.—This group consists of deep to moderately deep, nearly level to gently sloping and undulating learns, clay loams, sandy clay loams, gravelly clay loams, clays, and silty clays. These soils are moderate to moderately slowly permeable and have a low to high available water capacity. They are on uplands.

Pasture and hayland group 7E.—This group consists of deep, nearly level clays that are very slowly permeable and have a high available water capacity. These soils are in depressed areas of uplands.

Pasture and hayland group 8A.—This group consists of deep, nearly level to gently sloping fine sandy loams that are moderately slow to very slowly permeable and have a high available water capacity. These soils are on uplands.

Pasture and hayland group 8C.—This group consists of deep, nearly level to gently sloping fine sandy loamy that are moderately permeable and have a medium available water capacity. These soils are on uplands.

Pasture and hayland group 9A.—This group consists of deep, nearly level to gently sloping loamy fine sands and fine sands that are moderately to slowly permeable and have a low or medium available water capacity. These soils are on uplands.

Pasture and hayland group 9B.—This group consists of deep, gently undulating to undulating fine sands and gravelly sandy loams that are rapidly to moderately slowly permeable and have a low available water capacity. These soils are on uplands.

Pasture and hayland group 13A.—This group consists of shallow to deep, nearly level to gently sloping and undulating silty clays, clay loams, and clays that are moderately to very slowly permeable and have a low or medium available water capacity. These soils are on uplands.

Pasture and hayland group 14A.—This group consists of shallow, gently sloping fine sandy loamy that are moderately permeable and have a low available water capacity.

Predicted Yields

Table 2 lists predicted yields of the principal crops grown in the county. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county and on information taken from research data. The predicted yields are average yields per acre that can be expected by farmers at the level of management that tends to produce the highest economic returns.

Yields are given for either dryland or irrigated farming or for both methods of farming if the soils are used for both methods. Not included in this table are soils that are used only as range or for recreation.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because their acreage is small or reliable yield data are not available.

The predicted yields given in table 2 can be expected if the following management practices are used:

For dryland:

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed.
3. Crop residue is managed to maintain soil tilth.
4. Minimum but timely tillage is used.
5. Measures to control insects, plant disease, and weeds are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Adapted crop varieties and high quality seed are used at recommended seeding rates.
8. Proper timing and methods of harvesting are used.
9. Pastures are properly used and grazing on them is rotated.

For irrigated lands, the following additional practices are used:

10. Irrigation water of suitable quality is used.
11. Irrigation is timed to meet the need of the soil and crop.
12. Irrigation systems are properly designed and efficiently used.
13. The soils are not tilled when wet.

Use of the Soils for Range

Jerry Turrentine, range conservationist, Soil Conservation Service, helped prepare this section.

Range is land that, for the most part, produces native plants that are suitable for grazing by livestock and that grow in sufficient quantity to justify use for that purpose. The climax plant community is made up principally of grasses, grasslike plants, forbs, and shrubs. Among the benefits that range produces are areas that can be used for wildlife habitat, recreation, posts and other wood products, yields of ground water and surface water, open spaces, and other esthetic purposes.

The grazing of domestic animals in Medina County dates back to the years just after the Civil War, but large numbers of cattle were not grazed until the mid 1880's when the first fences were built across the range. Because the grazing was heavy and continuous and because there were periodic droughts, the more desirable perennial grasses in the plant community decreased until by the turn of the century thorny brush and other less desirable plants had begun to increase. In many areas the soils of the range were bare, and the burning and feeding of pricklypear cactus became common practices.

In Medina County, at present, ranching and farming are the main enterprises and are about equal in importance. About 73 percent of the total land area is native grazing land. At the time this survey was made, there were 250 ranches that ranged from 950 to 18,000 acres in size. On most ranches, hay, grain sorghum, small grain, hybrid sorghum, and other supplemental forage crops are grown. On many ranches, improved pastures of Coastal bermudagrass, Kleingrass, blue panicum, buffelgrass, Gordo bluestem, and other grasses contribute an important part of the forage. The livestock are predominantly cattle, but there are a few sheep and goats. Most of the ranches are cow-calf operations. The calves are generally marked at weaning or soon after. In years when an excessive amount of forage is produced, stock is run in winter on a few ranches or calves are carried over from the base herd.

The soils on the Edwards Plateau are underlain by lime-stone and are predominantly shallow or very shallow and stony. On this plateau the main tree in the overstory is live oak. The soils of the Rio Grande Plain are deeper and less sloping. On this plain the main woody plants are mesquite, blackbrush acacia, and guajillo.

Of the two distinctive growing seasons in Medina County, one is the period from April through June when rainfall and temperature are the most favorable and production is greatest. The other is the period September and October when rainfall is generally lighter, night temperatures are cool, and less forage is produced. During July and August the growth of forage plants is retarded because the rainfall is low and temperatures are high. Warm-season plants grow little in the period December through March because of the soil temperatures, the low rainfall, and the short days.

Range sites and condition classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community; it reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep range in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. The problem is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of the range sites

In the following pages, the soils, or range sites of Medina County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. The range site of each soil in the county is listed in the "Guide to Mapping Units" at the end of this soil survey.

Adobe range site

The soils of this site are very shallow to shallow, gently sloping and undulating loams or gravelly clay loams on uplands. Areas where many ledges of hard limestone crop out have a "benched" appearance. Because permeability is moderate to moderately slow and the available water capacity is very low, the production on this site is limited in dry years but is high in wet years.

The climax plant community is a savannah of tall and mid grasses and scattered Texas oak and small live oak. The approximate composition, by weight, of the climax plant community is 60 percent big bluestem, little bluestem, and indiangrass; 8 percent side-oats grama, tall dropseed, and meadow dropseed; 8 percent hairy dropseed and tall grama; 9 percent other grasses; 6 percent live oak and Texas oak; 4 percent evergreen sumac, littleleaf sumac, and kidneywood; and 5 percent forbs and annual grasses.

When the site is subjected to heavy grazing, big blue-stem, little bluestem, indiangrass, and side-oats grama decrease. Seep muhly, threeawn, and juniper increase.

Because the soil contains a large amount of free lime many minerals are not available. Because livestock do not prefer grazing this site, the distribution of grazing can be a problem.

If this range site is in excellent condition, the annual yield of air-dry herbage ranges from about 3,500 pounds per acre in favorable years to 1,500 pounds in unfavorable years.

Clayey Bottomland range site

The soils of this site are deep, nearly level clay loams on bottom lands and in valleys along major streams. This site is subject to flooding. Permeability is moderately slow, and the available water capacity is high.

The climax plant community consists of grass and scattered large oak, elm, hackberry, and ash trees. The approximate composition, by weight, of the climax plant community is 20 percent twoflower trichloris, fourflower trichloris, and pink pappusgrass; 10 percent big cenchrus and big sacaton; 10 percent plains bristlegrass and southwestern bristlegrass; 15 percent buffalograss; 15 percent vine mesquite and white tridens; 5 percent knotroot bristlegrass and filly panicum; 5 percent sedges; 10 percent oaks, elms, hackberry, ash, woody vines, greenbrier, and clematis; 8 percent sensitivebrier, snoutbean, bundleflower, frog-fruit, blood ragweed, and ruellia, and 2 percent annual forbs.

As the condition of the range deteriorates, trees and shrubs increase or invade in many places and trichloris, bluestems, and other shade-sensitive prairie grasses decrease. Buffalograss and other annual grasses and forbs tend to increase in open areas that are closely grazed. Common invaders are prairie coneflower, annual grasses, and forbs.

Forage plants on this site respond readily to brush control, deferment of grazing, range seeding, or other needed management practices. Where brush and trees are dense, forage production can be increased by controlling undesirable plants with chemical sprays or mechanical methods. After a period of deferred grazing, perennial grasses should increase in quantity and quality.

If this range site is in excellent condition, the annual yield of air-dry herbage ranges from 5,000 pounds per acre in favorable years to 3,000 pounds in unfavorable years.

Clay Flat range site

The soils of this site are deep, nearly level to gently sloping clays, mainly on broad upland plains. These soils crack when dry. Permeability is very slow, and the available water capacity is high.

The climax plant community is dominated by mid grasses. Mesquite is sparsely scattered throughout the open grassland. The approximate composition, by weight, of the climax plant community is 5 percent alkali sacaton; 30 percent twoflower trichloris and fourflower trichloris; 10 percent Arizona cottontop; 10 percent Texas cupgrass and pink pappusgrass; 10 percent pinhole bluestem and silver bluestem, 5 percent white tridens, 5 percent Texas wintergrass and bristlegrass, 10 percent vine-mesquite, 5 percent plains lovegrass and fall witchgrass; 5 percent buffalograss and curlymesquite; 5 percent annual forbs and perennial legumes; and scattered woody plants.

Under continuous heavy grazing by cattle, twoflower trichloris, fourflower trichloris, Arizona cottontop, Texas cupgrass, and pink pappusgrass decrease. As the condition of the range deteriorates, buffalograss increases first and then mesquite and other scattered brush. Common invaders are red threeawn, Halls panicum, red grama, and huisache. When overgrazing is prolonged, annuals increase and total production is greatly reduced.

Forage plants on this site respond to brush control, proper grazing use, and deferred grazing. Where brush and trees are dense, forage production can be improved by controlling undesirable plants with chemical sprays or mechanical methods. The range can then be rested to allow grass to grow.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,750 pounds per acre in favorable years to 2,250 pounds in unfavorable years.

Clay Loam range site

The soils of this site are deep, nearly level to sloping and gently undulating clays, clay loams, gravelly clay loams, or sandy clay loams in upland areas. Permeability is moderately slow to moderate, and the available water capacity is low to high.

The climax plant community is dominated by mid grasses, but a few mesquite trees or woody shrubs also grow on the open grassland. The composition, by weight, of the climax plant community is 35 percent twoflower trichloris, and fourflower trichloris, and little bluestem; 5 percent Arizona cottontop; 10 percent pinhole bluestem and silver bluestem, 10 percent plains bristlegrass and spike bristlegrass, 5 percent side-oats grama; 10 percent buffalograss and curly mesquite; 10 percent pink pappusgrass; 5 percent perennial threeawn; 5 percent mesquite, desert yaupon, guayacan, and other woody plants; and 5 percent orange zexmenia, bundleflower, and other perennial and annual forbs.

Under continuous heavy grazing by cattle, trichloris, little bluestem, Arizona cottontop, and bristlegrass decrease. As the condition of the range deteriorates, mesquite, whitebrush, and other mixed brush form a dense canopy. Common invaders are red grama, purple threeawn, leatherstem, tumblegrass, huisache, ragweed, and tasajillo. If denuded, the bare soil crusts, and the intake of moisture as well as the growth of seedlings is retarded.

Forage plants on this site respond readily to brush control, proper grazing use, range seeding, or other necessary management practices. After brush is controlled

by mechanical or chemical means, the range can be rested or grazing can be rotated so that the perennial grasses can grow and the quality and quantity of forage production increased.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 4,200 pounds per acre in favorable years to 2,500 pounds per acre in unfavorable years.

Deep Redland range site

The soils of this site are deep, nearly level to gently sloping clays. They are on uplands in valley-like areas or on benches below the steeper limestone hills. Permeability is very slow, and the available water capacity is high.

The climax plant community is an open savannah of mid and tall grasses and some perennial forbs and oaks. The approximate composition, by weight, of the climax plant community is 45 percent little bluestem and indiangrass; 20 percent side-oats grama and pinhole bluestem; 5 percent Texas cupgrass and meadow dropseed; 5 percent vine-mesquite and white tridens; 10 percent Canada wildrye, Texas wintergrass, and plains lovegrass; 5 percent buffalograss, curlymesquite, and sedges; 5 percent post oak, blackjack oak, live oak, and greenbrier, 4 percent Engelmanndaisy, bush sunflower, sensitivebrier, and mallows; and 1 percent annual forbs.

As the condition of the range deteriorates, little bluestem, indiangrass, and Texas cupgrass decrease. Texas wintergrass, curlymesquite, and buffalograss increase. Ashe juniper, Texas persimmon, pricklypear, and whitebrush are woody invaders.

This site produces forage of high quality. Good management practices, such as deferred grazing, rotational grazing, and proper grazing use, may be all that is needed on this site.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,500 pounds per acre in favorable years to 2,500 pounds in unfavorable years.

Deep Sand range site

The soils of this site are deep, nearly level to gently sloping fine sands on upland plains that have few drainageways. Permeability is moderately slow, and the available water capacity is low.

The climax plant community is dominated by tall and mid grasses. A few mesquite trees dot the open grassland, and there are a few scattered large live oak trees. The approximate composition, by weight, of the climax plant community is 50 percent seacoast bluestem; 5 percent brownseed paspalum; 15 percent indiangrass and switchgrass; 5 percent tanglehead; 5 percent fringeleaf paspalum; 5 percent balsamscale, sand dropseed, and Wright threeawn; 5 percent hooded windmillgrass and knotroot panicum; 5 percent gulfdune paspalum, fall witchgrass, and sand witchgrass; 3 percent mesquite, live oak, traces, snoutbean, western indigo, sensitivebrier, gayfeather, and bullnettle; and 2 percent beebalm and other annuals.

Under continuous heavy grazing by cattle, seacoast bluestem, brownseed paspalum, indiangrass, switchgrass, and tanglehead decrease. Threeawn, grassbur, and beebalm increase. Overgrazing for long periods results in a change of vegetation to a complex of invading annual weeds and grasses and production that is much lower than when the site is in excellent condition.

Forage on this site is of low quality. Small amounts of rainfall are used, but keeping production high is difficult if the range is used continuously.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 4,000 pounds per acre in favorable years to 2,500 pounds in unfavorable years.

Deep Sand Savannah range site

The soils of this site are deep, gently undulating fine sands on uplands. Permeability is rapid to moderately slow, and the available water capacity is low.

The climax plant community consists of scattered mesquite and abundant forbs on open grassland. The approximate composition, by weight, of the climax plant community is 45 percent little bluestem, seacoast bluestem, crinkleawn, and switchgrass; 10 percent brownseed paspalum, tanglehead, and side-oats grama; 10 percent Arizona cottontop, Texas cottontop, and feathery bluestem; 5 percent hooded windmillgrass; 10 percent knotroot panicum, spike bristlegrass, and plains bristlegrass; 5 percent fall witchgrass, and balsamscale, 5 percent perennial threeawn, pink pappusgrass, and slender grama; 5 percent live oak, mesquite, pricklypear, tasajillo, hackberry, lantana, condalias, spiny hackberry, Texas colubrina, and wolfberry; 3 percent bushsunflower, orange zexmenia, daleas, snoutbean, western indigo, gayfeather, sensitivebrier, dayflower, and verbena; and 2 percent ragweed, mallow, croton, and annual forbs.

As the condition of the range deteriorates, the taller grasses decrease and are replaced by invading annual forbs, red lovegrass, hairy grama, signalgrass, and grassbur. Mesquite, spiny hackberry, lantana, and pricklypear also increase. As the woody plants increase, the total production decreases.

This site can be reseeded successfully. It deteriorates rapidly under heavy grazing, but it responds favorably to good management.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from about 3,000 pounds per acre in favorable years to 2,000 pounds in unfavorable years.

Gravelly Ridge range site

The soils of this site are very shallow to deep, well-drained, gently sloping to sloping, and undulating to rolling, gravelly sandy loams, gravelly loams, or gravelly sandy clay loams on low knolls or long narrow ridges of the uplands. Permeability is moderate to slow in the indurated caliche, and the available water capacity is very low to low.

The climax plant community is mid grasses that are interspersed with guajillo, blackbrush, and other low-growing browse on semiopen grassland. The approximate composition, by weight, of the climax plant community is 35 percent tanglehead, Arizona cottontop, and pinhole bluestem; 5 percent lovegrass tridens; 15 percent side-oats grama, slender grama, and green sprangletop; 5 percent Texas bristlegrass; 5 percent threeawn and slim tridens; 5 percent hooded windmillgrass, Nash windmillgrass, and fall witchgrass; 20 percent guajillo and blackbrush acacia; 5 percent spiny hackberry, kidneywood, guayacan, and live oak; 5 percent bushsunflower, orange zexmenia, snoutbean, and guara; and a few annual forbs.

Under heavy continuous grazing by cattle, tanglehead, Arizona cottontop, and pinhole bluestem decrease. As the condition of the range deteriorates, blackbrush and guajillo dominate and threeawn and Texas bristlegrass occupy the understory. In a deteriorated condition, the annual production of herbage is much reduced.

Response to breaking the soil and reseeding is good. Brush control, proper grazing use, deferred grazing, or rotational grazing can greatly improve the stand of forage plants.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from about 3,000 pounds per acre in favorable years to 1,500 pounds in unfavorable years.

High Lime range site

The soils of this site are deep, nearly level to gently sloping loams on stream terraces and outwash plains. These soils are high in content of calcium carbonate and are powdery or crusty when bare. Permeability is moderate, and the available water capacity is medium.

The climax plant community is a mixture of grasses, forbs, and low shrubs. The approximate composition, by weight, of the climax plant community is 15 percent Arizona cottontop; 20 percent twoflower trichloris; 10 percent green sprangletop; 10 percent southwestern bristlegrass and plains bristlegrass; 10 percent pink pappusgrass and Nash windmillgrass; 10 percent knotroot panicum, slim tridens, threeawn, fall witchgrass, and hooded windmillgrass; 10 percent curlymesquite; 10 percent guajillo, guayacan, mescalbean, lime prickly-ash, kidneywood, elbowbush, desert yaupon, spiny hackberry, ceniza, and ephedra; and 5 percent orange zexmenia, bushsunflower, mallows, bundleflower, and annual forbs.

Continuous heavy grazing by cattle causes Arizona cottontop, twoflower trichloris, and green sprangletop to decrease. Texas bristlegrass, plains bristlegrass, pink pappusgrass, Nash windmillgrass, and slim tridens increase. As the condition of the range deteriorates, red grama, Texas grama, annuals, gray coldenia, and other plants invade, and the annual production of herbage declines.

The site is droughty because of the very high content of lime. A good plant cover should be maintained to increase intake of water and reduce evaporation.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from 2,500 pounds per acre in favorable years to 1,500 pounds in unfavorable years.

Lakebed range site

The soils of this site are deep, nearly level clays in depressions on uplands. This site receives from the surrounding areas, excess water that stands for varying lengths of time. Permeability is very slow, and the available water capacity is high.

The climax plant community is an open grassland that is wet to varying degrees. The approximate composition, by weight, of the climax plant community is 40 percent Hartweg paspalum; 10 percent spike lovegrass; 10 percent white tridens; 5 percent buffalograss; 10 percent switchgrass; 5 percent knotroot bristlegrass; 10 percent sedges and rushes; 5 percent knotgrass paspalum; and 5 percent annual forbs.

Under continuous heavy grazing, Hartweg paspalum, spike lovegrass, switchgrass, and white tridens decrease. Buffalograss sedges and rushes increase. As the condition of the range deteriorates, mesquite, huisache, retama, bermudagrass, and annual forbs invade, and the production of herbage decreases.

The plant community varies with the frequency and depth of flooding. Stocking rates should generally be based on onsite determination.

Under excellent growing conditions, the annual yield of air-dry herbage is approximately 3,000 pounds per acre; under unfavorable conditions it is 1,000 pounds per acre. Production varies greatly from site to site.

Loamy Bottomland range site

The soils on this site are deep, nearly level to gently sloping loams. These soils are on the low terraces of old flood plains that are now too high to be flooded as well as on flood plains that are subject to flooding. Permeability is rapid, and the available water capacity is very low.

The climax plant community is a mixture of trees, shrubs, grasses, and forbs that varies depending on the position and frequency and amount of flooding or overflow. The approximate composition, by weight, of the climax plant community is 30 percent fourflowered trichloris and little bluestem; 10 percent big cenchrus, switchgrass, and southwestern bristlegrass; 10 percent Texas wintergrass and Virginia wildrye; 5

percent white tridens and Wrights sacaton; 10 percent vine mesquite; 15 percent side-oats grama, buffalograss, pink pappus, and plains bristlegrass; 15 percent live oak, pecan, hackberry, woody vines, elm, willow, and other woody plants; 3 percent spiderlily, dayflower, bundleflower, hairy ruellia, Engelmanndaisy, catclaw, sensitivebrier, and yellow neptunia; and 2 percent annual forbs.

Under continuous heavy grazing by cattle, fourflowered trichloris, little bluestem, big cenchrus, switchgrass, and southwestern bristlegrass decrease. As the condition of the range deteriorates, bermudagrass, hooded windmillgrass, fall witchgrass, whorled dropseed, and red grama increase. With further deterioration, red threeawn, tumblegrass, fringed signalgrass, huisache, and other woody vegetation increase or invade, and the total production of herbage is less.

Conditions are favorable for the growth of tall grasses and trees. In some years, the control of thick stands of trees and brush by mechanical or chemical methods is needed so that the stand of native grasses can improve. The control of weeds is likely to be a problem in frequently flooded areas.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from about 3,500 pounds per acre in favorable years to 2,000 pounds in unfavorable years.

Low Stony Hill range site

The soils in this site are very shallow to shallow, gently sloping to sloping and undulating to hilly clays on uplands. Permeability is moderately slow, and the available water capacity is low.

The climax plant community is a savannah of grasses, forbs, oak trees, and many small shrubs. A great variety of plants grow as a result of variations of the soil and depth to limestone. The approximate composition, by weight, of the climax plant community is 30 percent little bluestem and indiangrass; 20 percent side-oats grama; 10 percent pinhole bluestem, cane bluestem, and green sprangletop; 5 percent fall witchgrass and plains lovegrass; 5 percent tall dropseed and meadow dropseed; 5 percent hairy dropseed, hairy grama, and Wright threeawn; 5 percent threeflower melic, Canada wildrye, carex, and Texas wintergrass; 5 percent live oak, shin oak, and Lacey oak; 5 percent sumacs, kidneywood, and other browse; 8 percent bushsunflower, Mexican sageworth, and other perennial forbs; and 2 percent annual forbs.

Under continuous heavy grazing by cattle and sheep, little bluestem, indiangrass, and side-oats grama decrease. Short or shade-tolerate plants, such as curlymesquite, hairy tridens, threeawn, and Texas wintergrass, increase. Usually the better low-growing browse plants decrease and live oak becomes dominant.

If properly managed (fig. 16), this site is productive. It is seldom bare of vegetation, since moisture is held among the surface rocks and in the fissures of the underlying limestone.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,000 pounds per acre in favorable years to 1,500 pounds in unfavorable years.

Figure 16.—Area of Low Stony Hill range site from which grazing has been excluded for a full growing season and the brush controlled by chaining and stacking. The soils are in the Tarrant series.

Redland range site

The soils of this site are shallow to moderately deep, gently sloping to sloping, and gently undulating to undulating clay loams to gravelly silt loams on uplands. Permeability is moderately slow to slow, and the available water capacity is low.

The climax plant community is a savannah consisting of post oak, blackjack, and live oak that grow in motts or as scattered trees. The approximate composition, by weight, of the climax plant community is 50 percent little bluestem; 10 percent indiangrass and big bluestem, 10 percent side-oats grama; 5 percent Canada wildrye, plains lovegrass, and Texas wintergrass; 5 percent hairy dropseed and meadow dropseed; 5 percent vine-mesquite and pinhole bluestem; 8 percent oaks; 2 percent hackberry and other browse; 4 percent sensitivebrier, Engelmanndaisy, and other perennial forbs; and 1 percent annual forbs.

Under continuous heavy grazing by cattle and sheep, little bluestem, indiangrass, big bluestem, and Canada wildrye decrease. Woody species increase, and mesquite, juniper, pricklypear and other plants invade. When over-grazing is prolonged, annual weeds and grasses make up a substantial part of the annual production and total production is greatly reduced.

The forage on this site is of high quality, because essential nutrients for livestock are available in adequate amounts. Control of grazing is often the only management needed, but in some areas, control of brush may also be needed.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 4,200 pounds per acre in favorable years to 2,000 pounds in unfavorable years.

Rolling Blackland range site

The soils of this site are deep to moderately deep, gently sloping to undulating, silty clays to clays on uplands. These soils often crack when dry. Permeability ranges from very slow to moderately slow, and the available water capacity is medium to high.

The climax plant community is dominated by mid and short grasses on an open prairie. The approximate composition, by weight, of the climax plant community is 15 percent alkali sacaton; 10 percent Arizona cottontop; 5 percent lovegrass tridens; 5 percent twoflower trichloris and four-flower trichloris; 20 percent sideoats grama and

vine-mesquite; 10 percent Texas cupgrass, pinhole bluestem, and silver bluestem; 20 percent Texas plains bristlegrass, southwestern bristlegrass, and Texas wintergrass; 10 percent curlymesquite and buffalograss; 4 percent woody plants, snoutbean, maximilian sunflower, and other perennial forbs, and 1 percent annual forbs.

Under continuous heavy grazing by cattle, alkali sacaton, Arizona cottontop, twoflower trichloris and fourflower trichloris decrease. Texas wintergrass, plains bristlegrass, curlymesquite, and buffelgrass are likely to increase. As the range deteriorates, red grama, red threeawn, tumble windmillgrass, Texas grama, and prairie coneflower invade the site. Mesquite, spiny hackberry, whitebrush, agarito, and pricklypear may dominate, resulting in less production of forage.

Because the soils on this site have a clayey surface layer, hoofpans may form and surface crusting is common. If the vegetation is removed, erosion is a hazard.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from about 4,000 pounds per acre in favorable years to 1,800 pounds in unfavorable years.

Sandy range site

The soils of this site are deep, nearly level to gently sloping, loamy fine sands on uplands. Permeability is slow to moderate, and the available water capacity is medium.

The climax plant community consists of mid and tall grasses in an open savannah where post oak and blackjack oak also grow. The approximate composition, by weight, of the climax plant community is 50 percent little bluestem; 10 percent indiangrass; 10 percent switchgrass, beaked panicum, sand lovegrass, crinkleawn, purpletop, and brownseed paspalum; 10 percent fringeleaf paspalum, balsamscale, tall dropseed, sedges, splitbead, and broomsedge bluestem; 10 percent post oak and blackjack oak; 5 percent hickory, greenbrier, honeysuckle, and grape, 5 percent lespedezas, sensitivebrier, snoutbean, wildbean, spiderwort, dayflower, and western indigo.

Under continued heavy grazing, little bluestem, indiangrass, and switchgrass decrease. In a deteriorated condition, red lovegrass, yankeeweed, bullnettle, and croton characterize the site. Among other common invaders are broomsedge bluestem, smutgrass, pricklypoppy, and annual grasses and forbs.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,500 pounds per acre in favorable years to 2,000 pounds in unfavorable years. About 500 to 1,000 pounds of this production is from woody species: Some or all of this production may not be palatable to or may be out of reach of grazing animals.

Sandy Loam range site

The soils of this site are deep, nearly level or gently sloping fine sandy loamy on uplands. Permeability is very slow to moderate, and the available water capacity is medium to high.

The climax plant community is dominated by mid grasses and in most places is made up of some climax forbs and woody plants. The approximate composition, by weight, of the climax plant community is 40 percent little bluestem, twoflower trichloris, and fourflower trichloris; 20 percent Arizona cottontop and feathery bluestem; 10 percent plains bristlegrass and spike bristlegrass; 10 percent hooded windmillgrass and Nash windmillgrass; 10 percent pink pappus, slim tridens, and other grasses; 5 percent condalias, blackbrush, kidneywood, vine ephedra, and other woody plants; 3 percent gayfeather, milk-pea, western indigo, and other perennial forbs; and 2 percent annual forbs.

As the condition of the range deteriorates, little bluestem, twoflower trichloris, fourflower trichloris, and Arizona cottontop decrease. Mesquite, blackbrush, and spiny hackberry are common increasers. Some common invaders are red lovegrass, red grama, red threeawn, Halls panicum, tumblewindmillgrass, and grassburs. When invading plants dominate, the amount of forage is greatly decreased.

This site responds to deferred grazing. The many kinds of vegetation can supply forage at any time of year if there is sufficient moisture. Seeded grasses can be established after brush has been controlled.

If the range is in excellent condition, the annual yield of air-dry herbage ranges from about 3,500 pounds per acre in favorable years to 2,500 pounds in unfavorable years.

Shallow, Edwards Plateau, range site

The soils of this site are shallow, gently sloping and gently undulating to undulating silty clays and clays on uplands. They are mostly below hills and adjacent to deep sites. Permeability is moderately slow to very slow in the indurated caliche, and the available water capacity is low.

The climax plant community is an open grassland characterized by mid grasses and scattered motts of live oak. The approximate composition, by weight, of the climax plant community is 25 percent little bluestem; 30 percent side-oats grama, 5 percent cane bluestem and silver bluestem; 10 percent plains lovegrass, Texas cupgrass, green sprangletop, and vine mesquite; 5 percent Texas wintergrass and Canada wildrye; 10 percent curlymesquite and buffalograss; 5 percent fall witchgrass; 3 percent live oak; 2 percent kidneywood and other browse; 3 percent guara, velvet bundleflower, and other perennial forbs; and 2 percent annual forbs.

Under continuous heavy grazing by cattle and sheep, little bluestem, side-oats grama, Texas cupgrass, and plains lovegrass decrease. Threeawn, red grama, Texas grama, hairy tridens, and annual forbs and grasses increase. Juniper, agrito, whitebrush, Texas persimmon, and mesquite invade and greatly reduce the annual production.

Forage plants on this site respond to brush control, proper grazing, and deferred grazing. The sloping soils erode if left without a good plant cover.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from 3,500 pounds per acre in favorable years to 2,000 pounds in unfavorable years.

Shallow, Rio Grande Plain, range site

The soils of this site are deep to shallow, nearly level to gently sloping and steep clay loams, clays, and gravelly clay loams on uplands. Permeability is moderate to very slow, and the available water capacity is low to medium.

The climax plant community is an open grassland of mid grasses and short grasses and a few scattered woody shrubs and perennial forbs. The composition, by weight, of the climax plant community is 40 percent pinhole bluestem and silver bluestem; 15 percent pink pappusgrass, Texas cupgrass, and side-oats grama; 10 percent vine-mesquite and plains bristlegrass; 5 percent Arizona cottontop; 5 percent plains lovegrass; 10 percent green sprangletop, buffalograss, curlymesquite, Texas wintergrass, and other grasses; 3 percent guajillo; 7 percent kidneywood, guayacan, blackbrush, desert yaupon, and other woody plants; 5 percent orange zexmenia, bush sunflower, Engelmanndaisy, bundleflower, sensitivebrier, and annuals.

Under continuous heavy grazing, pinhole bluestem and little bluestem decrease. Texas wintergrass, side-oats grama, vine-mesquite, buffalograss, and curlymesquite increase. As the condition of the range deteriorates, slim tridens, red grama, and annual grasses and forbs invade. Woody invaders are mesquite, blackbrush, spiny hackberry, catclaw, and guajillo.

Forage plants on this site respond to brush control and good management of grass. Where mesquite and blackbrush have invaded overgrazed areas, brush can be controlled by rootplowing or applying chemical sprays. Excluding grazing during the growing season helps insure the establishment of seeded or native perennial grasses.

If the site is in excellent growing condition, the annual yield of air-dry herbage ranges from about 2,200 pounds per acre in favorable years to 1,000 pounds in unfavorable years.

Shallow Ridge range site

The soils on this site are very shallow to shallow, gently sloping to sloping, and undulating gravelly clay loams on uplands. Permeability is moderate, and the available water capacity is very low.

The climax plant community is dominated by mid grasses, but low-growing brush is scattered on the grassland. The approximate composition, by weight, of the climax plant community is 20 percent Arizona cottontop; 20 percent side-oats grama and little bluestem; 20 percent pinhole bluestem, green sprangletop, and twoflower trichloris; 5 percent slim tridens, threeawn, and sand dropseed; 10 percent fall witchgrass; Nash windmillgrass, hairy grama, curly mesquite, and Texas bristlegrass; 10 percent tanglehead; 5 percent guajillo; 2 percent blackbrush; 1 percent kidneywood; 1 percent elbowbush; 1 percent ephedra; 4 percent bush sunflower, orange zexmenia, Engelmanndaisy, evening primrose, and halfshrub sundrop; and 1 percent annuals.

Under continuous heavy grazing by cattle, Arizona cottontop, side-oats grama, little bluestem, and twoflower trichloris decrease. Slim tridens, sand dropseed, fall witch-grass, and Nash windmillgrass increase. Among the common invaders, red threeawn, red grama, Halls panicum, Texas grama, and tumble windmillgrass are dominant, but there is a heavy increase of guajillo and ceniza. Maintaining a good cover of grass results in more efficient use of the limited amount of water that this site can store. Grass cover decreases surface runoff and reduces the water lost through evaporation.

If the site is in excellent condition, the annual yield of air-dry herbage ranges from about 2,500 pounds per acre in favorable years to 1,000 pounds in unfavorable years.

Shallow Sandy Loam range site

The soils of this site are shallow, gently sloping, fine sandy loams on uplands. Permeability is moderate, and the available water capacity is low.

The climax plant community is an open grassland that has a few scattered woody plants and many forbs. The approximate composition, by weight, of the climax plant community is 30 percent feathery bluestem, tanglehead, Arizona cottontop, and little bluestem; 15 percent fall witchgrass and slim tridens; 10 percent bristlegrass; 10 percent hooded windmillgrass; 10 percent sand dropseed, perennial threeawn, and pink pappusgrass; 10 percent gummy lovegrass, Texas tridens, hairy tridens, slender grama, and red grama; 3 percent guajillo; 2 percent blackbrush, leather stem, guayacan, and other brushy plants; 5 percent orange zexmenia, catclaw sensitivebrier, bushsunflower, snoutbean, and croton; and 5 percent annual forbs.

As the condition of the range deteriorates, feathery bluestem, tanglehead, Arizona cottontop, and little bluestem decrease and are replaced by bristlegrass, sand dropseed, and hooded windmillgrass. With continued overgrazing, guajillo may disappear from the site and be replaced with blackbrush.

This site requires deferred grazing or rotational grazing to maintain productivity. Mechanical or chemical brush control is needed in many areas to help return the better forage plants to their former density.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,000 pounds per acre in favorable years to 1,500 pounds in unfavorable years.

Steep Adobe range site

The soils of this site are shallow, hilly to steep loams on uplands. They are mainly near outcrops of hard limestone at the tops of hills, and they adjoin less sloping areas. Rocky ledges often give a "stairstep" appearance to the landscape. Permeability is moderately slow, and the available water capacity is very low.

The climax plant community is a savannah of tall grasses and scattered live oak and Texas oak. Fire was probably important in maintaining the vegetation as a savannah. The approximate composition, by weight, of the climax plant community is 52 percent little bluestem and indiangrass; 10 percent tall dropseed, meadow dropseed, and side-oats grama; 10 percent hairy dropseed and tall grama; 8 percent plains lovegrass, Lindheimer muhly, Texas wintergrass, and other grasses; 10 percent Texas oak and live oak; 5 percent Texas madrone, Ashe juniper, Lacey oak, and sumacs; and 5 percent dotted gayfeather, queen's delight, and other perennial forbs.

Under continuous heavy grazing by livestock, little blue-stem, indiangrass, tall dropseed, meadow dropseed, and side-oats grama decrease. Queen's delight, gray goldaster, juniper, yucca, agrito, seep muhly, purple threeawn, hairy tridens, hoarhound mescalbean, Texas grama, and persimmon increase and invade.

Because of poor mineral balance, livestock do not readily graze this site. Consequently, the distribution of grazing may be a problem.

In this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,000 pounds per acre in favorable years to 1,000 pounds in unfavorable years.

Steep Rocky range site

The soils of this site are very shallow to shallow, steep clays, on uplands, underlain by limestone. Permeability is moderately slow, and the available water capacity is low.

The climax plant community consists of an understory of mixed tall grass and mid grass and an overstory of Texas oak, shin oak, and live oak. The approximate composition, by weight, of the climax plant community is 30 percent little bluestem and indiangrass; 25 percent side-oats grama, Nealley grama, and green sprangletop; 5 percent plains lovegrass, tall dropseed, hairy dropseed, and Texas cupgrass; 5 percent perennial threeawn; 5 percent fall witchgrass; 5 percent slim tridens. rough tridens, tall grama, hairy grama, Texas wintergrass, Halls panicum, and carex; 5 percent kidneywood, elbowbush, sumac, Texas madrone, and hackberry; 5 percent Ashe juniper; 5 percent live oak, Lacey oak, shin oak, and Texas oak; 10 percent Engelmanndaisy, bush sunflower, orange zexmenia, bundleflower, daleas, sensitivebrier.

Under continuous heavy grazing by cattle and sheep, little bluestem, indiangrass, side-oats grama, green sprangletop, and plains lovegrass decrease. Hairy tridens, Texas grama, red grama, and some annual forbs invade and replace the better grasses. Ashe juniper is the primary woody invader; it can dominate the site and greatly reduce production.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 1,700 pounds per acre in favorable years to 1,000 pounds in unfavorable years.

Tight Sandy Loam range site

The soils of this site are deep, nearly level to gently sloping fine sandy loams on uplands. Permeability is moderately slow to very slow, and the available water capacity is high.

The climax plant community is dominated by mid grass. Mesquite and other woody brush are scattered in the open grassland. The approximate composition, by weight, of the climax plant community is 25 percent little bluestem, twoflower trichloris, and fourflower trichloris; 10 percent feathery bluestem; 5 percent tanglehead; 5 percent Arizona cottontop; 5 percent plains bristlegrass or spike bristlegrass; 10 percent Nash windmillgrass and hooded windmillgrass; 10 percent pink pappusgrass; 5 percent fall witchgrass and plains lovegrass; 5 percent slender grama and threeawn; 10 percent buffalograss and curlymesquite; 5 percent Texas kidneywood, vine ephedra, mesquite, condalia, spiny hackberry, and guajillo; 4 percent bush sunflower, Engelmanndaisy, orange zexmenia, and perennial legumes; and 1 percent annual forbs.

Under continuous heavy grazing, little bluestem, twoflower trichloris, and fourflower trichloris are among the first grasses to decrease. As the condition of the range deteriorates, mesquite, condalias, spiny hackberry, and woody plants form a dense canopy. Common invaders are broomweed, crotons, cactus, red grama, Texas grama, sandbur, and lantana.

Deferred and rotational grazing are needed for maximum yields. If the site is allowed to deteriorate, it recovers slowly, and erosion is a hazard if an adequate cover of vegetation is not maintained.

If this site is in excellent condition, the annual yield of air-dry herbage ranges from approximately 3,500 pounds per acre in favorable years to 1,700 pounds in unfavorable years.

Use of the Soils for Wildlife

In Medina County, the principal kinds of wildlife are whitetailed deer, turkey, javelina, fox squirrel, bobwhite quail, scaled (blue) quail, dove, cottontail rabbit, jackrabbit, and numerous kinds of nongame birds. Exotic game animals, such as mouflon sheep, axis deer, elk, black buck antelope, and Russian boar have been introduced into the county. There are raccoons, foxes, ringtail cats, skunks, opossum, beavers, and other furbearers. The predators are mainly bobcats and coyotes and a few mountain lions.

Lakes, streams, ponds, and grain fields attract ducks and geese during migration. Most farm and ranch ponds are stocked with channel catfish, black bass, and sunfish; and the perennial streams and Medina Lake offer good fishing. Fish and wildlife resources are of great economic importance to landowners and merchants in the county.

Soils directly influence kinds and amounts of vegetation and amount of water available, and in this way indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the wildlife habitat are depth of the soils, texture of the surface layer, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability of the soil to air and water.

In table 3 the soils of this survey area are rated on the basis of their suitability for producing four elements of wildlife habitat and for two groups, or kinds, of wildlife. A rating of *good* means that the element of wildlife habitat generally is easily created, improved, and maintained. Few or no limitations affect management, and satisfactory results can be expected.

A rating of *fair* means that the element of wildlife habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention may be required for satisfactory results.

A rating of *poor* means that the limitations for the designated use are severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *very poor* means that the limitations are very severe and that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

Each soil is rated in table 3 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitat. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account present use of soils or present distribution of wildlife and people. For this reason, onsite inspection is necessary of an area proposed for development as a habitat for wildlife.

Grain and seed crops.—These crops are annual grain-producing plants, such as corn, sorghum, small grain, and sunflower.

Grasses and legumes.—Making up this group are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Examples of grasses are kleingrass, ryegrass, and panicgrass; examples of legumes are annual lespedeza and other clovers.

Wild herbaceous upland plants.—This group consists of native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. On range, the typical plants are bluestem, grama, perennial forbs, and legumes.

Trees and shrubs.—These plants provide cover and shade for some wildlife, and they produce buds, twigs, bark, and foliage, which are used as food by wildlife. Typical plants are live oak, post oak, shinnery oak, mesquite, catclaw, whitebrush, guajillo, guayacan, and Texas kidneywood.

Wetland food and cover plants are not included in table 3. In Medina County, Tiocano soils are rated fair for this element of wildlife habitat and all the other soils are rated poor or very poor. Some annual and perennial herbaceous plants grow wild on moist or wet sites. They furnish food and cover mostly for wetland wildlife. Some typical wetland plants are smartweed, wild millet, spikerush and other rushes, sedges, burreed, tearthumb, and aneilema. Sub-merged and floating aquatics are not included in this category.

Shallow water developments also are not shown in table 3. These developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments where submerged aquatics grow. Tiocano and Victoria soils are fair for water developments. All other soils in the county are poor or very poor.

Table 3 rates the soils according to their suitability for providing habitat for the two main kinds of wildlife in the county—openland and range wildlife. The ratings are related to those made for the elements of habitat. For example, soils rated very poor for domestic grasses and legumes are rated very poor for openland wildlife.

Openland wildlife.—These are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, sandhill cranes, cottontail rabbits, and foxes are typical openland wildlife.

Range wildlife.—These are birds and mammals that normally live in brushy areas of small trees, coniferous trees, and shrubs. Woodcocks, thrushes, wild turkeys, vireos, deer, squirrels, and raccoons are typical woodland wildlife. Deer, turkey, javelina, raccoon, and coyote are typical range wildlife.

There is some wetland wildlife in the county. Ducks, geese, herons, beavers, and nutria, for example, live in wet areas, marshes, and swamps. Tiocano soils are fair for wetland wildlife. All the other soils in Medina County are rated poor or very poor for this kind of wildlife.

Use of the Soils for Recreation

Many scenic, natural, and historical areas in Medina County have a potential for recreation use. Many of these areas are inaccessible at present.

The Medina River, a perennial stream that flows through the county, and Medina Lake have potential for waterbased recreation enterprises. And the great number of small ponds on farms and ranches and intermittent waterholes along nonflowing streams also have good possibilities. Ranches in the county have potential for development as hunting areas.

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 4 the soils of Medina County are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

In table 4 the degree of limitation is expressed as slight, moderate, or severe. For all of these, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. Severe means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, and a surface free of rocks and coarse fragments and are not subject to flooding during periods of heavy use; their surface is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts that carry heavy foot traffic. Most of the vehicular traffic is confined to access roads. The best soils are firm when wet but not dusty when dry, are not subject to flooding during the season of use (fig. 17), and do not have slopes or stones that can greatly increase the cost of leveling or of building access roads.

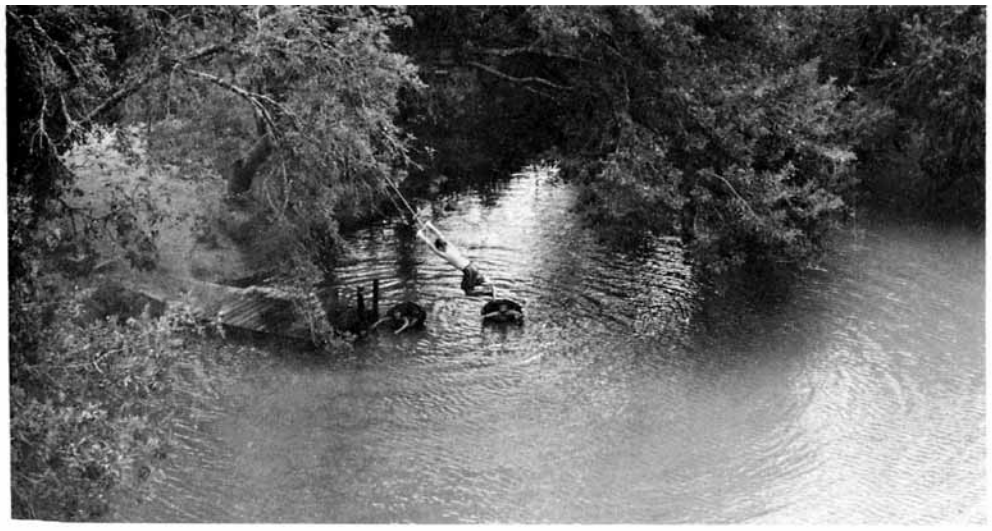

Figure 17.—A recreation area, on the Medina River, protected from flooding by the dam at Medina Lake. The soil is Divot clay loam, frequently flooded.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops. They have good drainage and are not subject to flooding during periods of heavy use. Their surface is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering Uses of the Soils

Joseph G. Miller, civil engineer, Soil Conservation Service, helped prepare this section.

This section is useful to planning commissions, town and city managers, land developers, engineers, contractors, farmers, and others who need information about soils used as structural material or as foundation on which structures are built.

Among soil properties highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.

5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to help predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables. Table 5 shows estimates of several soil properties significant in engineering. Table 6 gives interpretations for various engineering uses. Table 7 shows results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 6 and it also can be used to make useful maps.

This information, however, does not eliminate need for investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil can include small areas of other kinds of soil that have strongly contrasting properties and different suitability or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists. The Glossary defines many of these terms.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system *(2)* used by the SCS engineers, the Department of Defense, and others, and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) *(1)*.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soil, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further break-down, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2-4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. The AASHTO classification for tested soils is shown in table 7; the estimated classification is given in table 5 for all soils mapped in the survey area.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to

have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Hydrologic groups give the runoff potential from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water after a long lasting storm occurring after prior wetting and opportunity for swelling, and without the protective effect of vegetation.

The major soil groups are described in the following paragraphs.

Group A. *(low runoff potential).*—Soils that have a high infiltration rate even when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. Water readily passes through these soils.

Group B.—Soils that have a moderate infiltration rate when thoroughly wet. These soils are chiefly moderately deep to deep, moderately well drained to well drained and are moderately fine textured to moderately coarse textured. These soils have a moderate rate of water transmission.

Group C.—Soils that have a slow infiltration rate when thoroughly wet are mainly those that have either a layer that impedes downward movement of water or moderately fine to fine texture. These soils have a slow rate of water transmission.

Group D *(high runoff potential)*.—Soils that have a very slow infiltration rate when thoroughly wet are mainly those clay soils that have a high shrink-swell potential, a permanent high water table, or a claypan or clay layer at or near the surface and are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to bedrock is distance from the surface of the soil to the rock layer.

Soil texture is described in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from semisolid to a plastic. If the moisture content is further increased, the material changes from plastic to liquid. The plastic limit is the moisture content at which the soil material changes from semisolid to plastic; and the liquid limit, from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume of soil material to be expected with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or with material having this rating.

Corrosivity pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations of the soils

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Medina County. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for irrigation, terraces and diversions, and grassed waterways. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the terms slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the use or that the limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation and special designs are required.

Soil suitability is rated by the terms *good, fair*, and *poor*, which have meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 6.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage, within a depth of 2 to 5 feet, long enough for bacteria to decompose the solids. A lagoon has a nearly level floor; its sides, or embankments, are of compacted soil material. The assumption is made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties that affect the pond floor are permeability, organic matter, and slope, and if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or absence of a high water table.

Dwellings without a basement are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavations are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 6 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet; nevertheless, every possible site should be investigated before one is selected.

Roads and streets have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load supporting capacity, stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other unsuitable material.

Dikes, levees, and other embankments require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compatibility. Stones or organic material in a soil are among factors that are unfavorable.

Road fill is soil material used in embankments for roads. The. suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material or plant response when fertilizer is added to the soil; and absence of substances toxic to plants.

Texture of the soil material and its content of stone fragments affect suitability, and also considered in the ratings is damage that can result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. Deposits of sand and gravel are in a few areas in the county, but these areas are indefinite in their occurrence and cannot be located from survey data. The Nueces, Orif, Patilo, and Poth soils are fair sources of sand. The Devine and Orif soils are fair sources of gravel. All the other soils mapped in Medina County are either poor or improbable sources of sand and gravel.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Textures that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways are constructed to carry excess runoff water through irrigated or dry cultivated fields, pasture, or hayland to a safe outlet without erosion or damage to structures needed to irrigate, manage, or protect the soil and crops. The factors considered in selecting soils for grassed waterways are those features that affect establishment, growth, and maintenance of plants and ease of construction of the waterway, such as texture and thickness of soil layers, steepness of slope, and susceptibility to erosion or siltation.

Soil test data

Table 7 contains engineering test data for some of the major soil series in Medina County. The tests were made to help evaluate the soils for engineering purposes. The engineering classifications are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Lineal shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when oven-dry.

Tests to determine liquid limit and plasticity index measure the effect of water on the consistence of soil material, as explained for table 5.

Formation and Classification of the Soils

This section discusses the factors of soil formation and the classification of the soils.

Factors of Soil Formation

The factors that determine the kind of soil that forms at any given point are the climate under which the soil material accumulated and weathered; the living organisms on and in the soil; the composition of the parent material; the relief, or lay of the land; and the length of time the forces of soil development have acted on the soil material. The relative importance of each factor differs from place to place, and each modifies the effect of the other four. In some places one factor may dominate in the formation of a soil.

Climate and living organisms, chiefly vegetation, are the active factors of soil formation. They alter the accumulated soil material and bring about the development of genetically related horizons. Relief, mainly by its influence on temperature and runoff, modifies the effect of climate and vegetation. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Usually, a long time is required for the development of distinct horizons.

Climate

Precipitation, temperature, humidity, evaporation, and wind have all been important in the formation of soils in Medina County. The wet climate of past geologic ages influenced the deposition of parent materials. The present climate, characterized by low rainfall, hot summers, and mild winters, also affects soil formation. Indications of this effect are the kind and density of vegetation, the organic-matter content of the soils, the leaching of soluble elements from the soil, and the activity of micro-organisms in the soil. Because rainfall is low, the vegetation is limited to grasses, shrubs, and small trees, except in some areas along streambeds. This vegetation contributes to the organic-matter content of the soils. Free lime is throughout the profile of most soils because not enough water has passed through them to leach out the lime. Many of the soils of Medina County have a layer of calcium carbonate at the depth to which water has carried this slowly soluble material.

Almost all of the precipitation in the county falls as rain. Some rain falls in torrents and removes soil material almost as rapidly as it forms, especially on the steeper slopes where the plant cover is sparse.

In some places one-half inch of rain may be enough to soak a very shallow, stony soil. Water runs over the stones, penetrates the soil, and finds its way under the stones and in the crevices where plant roots can use it. Much of the water also percolates below the zone of evaporation. In other places one-half inch of rain may wet only the upper two inches of a clay soil, and the moisture may evaporate soon after. On the stony soil one-half inch of rain may be more effective for plant growth than one inch would be on the clayey soil that has no stones. The stony soils support tall grasses, in contrast to the clayey soils that support only short grasses.

During the hot summers and mild winters, microbial de-composition is almost continuous, and the residue from plants and animals break down almost as rapidly as they accumulate. For this reason, the organic-matter content of most soils in the county is less than 2.5 percent.

Living organisms

Plants, animals, insects, bacteria, and fungi are important to soil formation. Native vegetation of the mixed prairie type has contributed large amounts of organic matter to the soil. The organic matter on the soil is in the form of decaying leaves and stems, but in the soil it is in the form of fine, fibrous, decomposed roots. These roots have left a network of tubes and pores that hasten the passage of air and water through the soil and provide food for bacteria and fungi.

Plant roots may take up calcium, potassium, phosphorus, or other nutrients in lower layers of soil. These elements are redeposited on the soil surface when the plants die. Burrowing animals also mix soil horizons as they build homes or gather food.

Earthworms are noticeable in the soil. Despite the low rainfall in this county and the periods when the upper part of the profile is dry, there are many earthworm casts in some soils. Besides mixing the soil, earthworms increase the downward movement of air and water, and the growth of plant roots in the soil.

Overgrazing has removed many kinds of grasses from the range and has encouraged other, less nutritious grasses, weeds, and brush to take their place. Now much of the range has sparse vegetation, which allows large amounts of rainfall to run off and carry soil with it. In addition, the sparse vegetation permits the soil temperature to rise in summer, and the heat kills many of the microbes in the soil. These changes affect soil formation.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It largely determines the chemical and mineralogical composition of the soil.

The parent material in Medina County derived mainly from limestone, marl, sandstone, shale, and clay. It may be loamy to clayey outwash or old limy alluvium, and recent alluvium.

Duval, Webb, and Wilco soils formed in parent material weathered or derived from sandstone. The weathering processes caused significant differences in the morphology of the soils.

Shale and clay weathered into the parent materials of Kincheloe, Mercedes, Monteola, Tiocano, Victoria, and other soils. Amphion, Atco, Caid, Castroville, Hanis, Knippa, Rehm, Sabenyo and other soils formed in loamy to clayey outwash or old alluvium that was transported by water and redeposited in its present place during the Pleistocene epoch (Ice Age). Deep soils formed in these unconsolidated sediments.

Divot and Orif soils formed in recent alluvium. These soils are deep and have varying degrees of development. Movement of calcium carbonate downward in the profile is evident in the Divot soils, but not in the Orif soils.

Relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The relief of Medina County ranges from nearly level to steep. Most of the county is well dissected into drainage patterns. The Edwards Plateau, which makes up the northern part of the county, is a rough region made up of ridges, hills, valleys, and canyons. Within short distances on this plateau, the elevation increases from 200 to 400 feet. In much of this area, slopes are more than 20 percent; lime-stone bedrock crops out in many places; runoff is very rapid or rapid; and geologic erosion removes the soil almost as rapidly, or nearly as rapidly, as it forms. The rugged hills are mapped as Tarrant-Rock outcrop-Brackett association, steep. At a slightly lower elevation on ridges and hills are soils that are shallow or very shallow to limestone. Examples of these are Brackett, Real, and Tarrant soils.

On the foot slopes or benches below the hills, and in the valleys are Kavett, Mereta, Pratley, Speck, and Topia soils. These are shallow to moderately deep soils. Divot and Orif soils are along the stream channels.

The Rio Grande Plain, which makes up the southern part of the county, consists mainly of areas that range from nearly level on the plain to gently sloping or undulating on the hills. Amphion, Atco, Caid, Castroville, Knippa, Mercedes, and other deep soils dominate the nearly level plain. Duval, Eufaula, Miguel, Nueces, Patilo, Poth, Webb, Wilco soils and other deep, sandy soils are in much of the gently sloping areas of the Rio Grande Plain. Hindes, Lacoste, Olmos, and Yologo soils and other moderately deep to very shallow soils dominate the higher ridges and low hills. The drainage pattern on the nearly level plain and in gently sloping areas is poorly defined but that on the ridges and low hills is well defined.

Relief affects the microclimate and the ecology in places. The steeper, north-facing slopes receive less sunlight than south-facing slopes and have a lower soil temperature and less evaporation. On most north-facing slopes, the vegetation is thicker than on south-facing slopes, the soil organisms are more numerous, and the plants and microorganisms are different. Also, they are not green so early in spring, and they receive less direct sunlight.

Time

A long time is required for the formation of distinct horizons. The differences in length of time that parent material has been in place are generally reflected in the degree of development of the soil profile.

The soils in Medina County range from young to old. The young soils have little horizon development, and the old soils have well expressed horizons. Orif soils are an example of young soils that have little horizon development. These soils have a calcareous A horizon, less than 18 inches thick, underlain by a calcareous C horizon that is gravelly and stratified. Duval soils are an example of the older soils that have more distinct horizon development. Duval soils have a darkened, noncalcareous A horizon and a thick Bt horizon that contains illuvial clay. These soils are noncalcareous in the upper part, but they contain a few soft masses of calcium carbonate and are calcareous in the lower part.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and range, in developing rural areas, in engineering work, and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 *(5)*. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties

that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Medina County are placed in three categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

The five orders to which the soils of Medina County belong are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols. Alfisols have a light-colored surface layer low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent. Entisols have little or no evidence of development of pedogenic horizons. Inceptisols have a light-colored surface layer low in organic matter, but lack a clay-enriched B horizon. Mollisols have a dark-colored surface layer high in organic matter and have a base saturation of more than 50 percent. Vertisols are clayey soils that have deep, wide cracks part of the year in most years.

SUBORDER. Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu*, meaning water or wet, and *ent*, from Entisol).

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Haplaquents* (*Hapl*, meaning simple horizons, *aqu*, for wetness or water, and *ent*, from Entisols).

SUBGROUP. Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is *Typic Haplaquents* (a typical Haplaquent).

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used to differentiate families (see table 8). An example is the coarse-loamy, siliceous, acid, thermic family of Typic Haplaquents.

Geology

In the following paragraphs, the geologic formations *(3)* in Medina County are described in order of oldest to youngest. They range from Lower Cretaceous to Recent in age. Most are marine in origin. If the origin is not marine, it is mentioned in the description of the formation. The oldest rocks, those of the Glen Rose Formation through Buda limestone, are 2,300 feet thick, and crop out in the northern part of the county.

The oldest formations, which are of Lower Cretaceous age, are the Travis Peak Formation and the Glen Rose Formation, but the Travis Peak Formation does not crop out in Medina County. The Glen Rose Formation crops out mainly in valleys and on the lower slopes below the steeper limestone hills in the northern part of the county. It consists of alternating beds of hard limestone and marl. Terrace relief has developed in areas where beds of the more easily eroded marl crop out. The soils that formed on the upper slopes in material weathered from this formation are those of the Brackett and Real series. Those that formed on benches in material weathered from the hard limestone are generally of the Tarrant series. These Tarrant soils are generally more gravelly and less stony than the Tarrant soils that formed in higher areas. Soils of the Pratley, Speck, and Topia series formed in areas where the Glen Rose Formation contains thicker pockets of marl or clayey materials.

The Walnut Formation, which is underlain by the Glen Rose Formation, is in the northern part of the county. It is sandy marl that is thin and difficult to distinguish from the Glen Rose Formation.

Outcrops of Comanche Peak Limestone and Edwards Limestone cap most of steeper hills in the northern part of the county but are in areas of more rolling relief in the southern part of the Edwards Plateau. Comanche Peak Limestone, which is underlain by Walnut Formation, has a nodular appearance and consists of massive limestone grading downward to sandy to argillaceous marl. Edwards Limestone, which is underlain by Comanche Peak Limestone, consists of massive beds of hard, dense, fine-grained, brittle limestone interbedded with a few layers of marl or thin-bedded limestone. It also contains flint or chert that occurs as thin beds, lenticular masses, and nodules. This formation is the most important reservoir of ground water in the county and furnishes water for public supply, irrigation, industry, domestic use, and livestock.

The soils that formed in materials weathered from Comanche Peak Limestone and Edwards Limestone are mainly dark-colored soils of the Tarrant series, but soils of the Dina, Kavett, Mereta, Pratley, and Speck series also formed in these materials. The Tarrant soils are on the steeper side slopes and caps, and the other soils are mainly on benches at the base of the steeper hills.

The Georgetown Formation, which is disconformably underlain by Edwards Limestone, is a dense, massive to thick-bedded limestone, the upper part of which has thin beds of argillaceous limestone and marl. Outcrops of this formation are scattered throughout the northwestern and north-central parts of the county. The principal soils that formed in material weathered from this formation are of the Tarrant, Kavett, Pratley, and Speck series.

Grayson Marl, formerly Del Rio Clay, underlain by the Georgetown Formation, consists of clay that is sandier in the upper part than in the lower part. Pyrite nodules are common in the upper part. Because the clay is relatively impermeable, surface reservoirs have been constructed where this marl crops out. Most of the outcrops are small, narrow, and eroded.

Buda Limestone, underlain by Grayson Marl, is fine-grained, dense, massive limestone that is relatively resist-ant to erosion. It crops out as fault scarps, bluffs,

and low hills. A few outcrops are honeycombed, but most have a nodular surface. The soils that formed in material weathered from this formation are similar to those that formed in material weathered from Edwards Limestone, Comanche Peak Limestone, and the Georgetown Formation.

Eagle Ford Shale is underlain by Buda Limestone. It consists of flaggy limestone in the upper part and laminated siltstone and sandstone and thin beds of brownish limestone in the lower part. Austin Chalk is underlain by Eagle Ford Shale. The upper part consists of massive chalky limestone that alternates with layers of marl and chalk. The lower part is dense, thin-bedded limestone. It is similar to the upper part of Eagle Ford Shale, but it contains less sand. Soils that formed in material weathered from Eagle Ford Shale and Austin Chalk are mainly in the Real and Olmos series. The Real soils formed over limestone and the Olmos soils over caliche.

Anacacho Limestone, which is underlain by Austin Chalk, consists of argillaceous thick-bedded limestone, chalk, marl, and sandy clay. The lowermost part is coarse grained and indurated, and some layers are impregnated with asphalt. Overlying this formation in the easternmost part of the county is massively bedded, bentonitic clay, believed to be a westward extension of Taylor Marl. The soils that formed in material weathered from the Anacacho Formation are mainly of the Real series.

Corsicana Marl, which is underlain by Anacacho Limestone, crops out north of D'Hanis where it has intercalated beds of shale. Soils that formed in material weathered from this formation are mainly of the Kincheloe series.

The Escondido Formation is the youngest formation of Cretaceous age in the county. It crops out in a broad, east-west belt in the central part of the county. In the western part of the county, it consists of flaggy, calcareous to argillaceous, fine-grained sandstone, thin-bedded siltstone, and shale and layers or lenses of sandy marl and limestone. In the eastern part, it is more strongly lithified, shaly clay. Soils that formed in areas where this formation is highly argillaceous are of the Monteola and Rehm series and in areas where sandier strata crop out are of the Caid series.

The Kincaid Formation, unconformably underlain by the Escondido Formation, is the only formation of Paleocene age that crops out in the county. In the eastern part of the county, the outcrops consist of glauconitic, sandy limestone that contains pyrite nodules over glauconitic, sandy shale. In the western part, it consists of arenaceous limestone that in places contains small balls of clay and glauconitic, calcareous sandy clay. Among the soils that formed in material weathered from this formation are those of the Monteola, Rehm, and Caid series.

The Indio Formation is the oldest formation of Eocene age in the county. It consists of thin-bedded argillaceous sandstone and laminated arenaceous shale and contains some lignite and pyrite. The proportion of sand increases as vertical distance from the top of the formation decreases. Among the soils that formed in material weathered from this formation are loamy and sandy soils of the Duval, Miguel, Webb, and Wilco series.

Carrizo Sand, which is underlain by the Indio Formation, extends in a belt across the southeastern part of the county. This part of the county is known as the area of "deep sands." This formation is not marine in origin but estuarine and deltaic. In general, it consists of sandstone that is an aggregate of subangular, medium-sized grains of quartz but has little or no mica, secondary gypsum, or calcite. In places it is limonitic and contains several thin beds of ferruginous sandstone. Among the soils that formed in this material are those of the Eufaula, Nueces, Patilo, and Poth series.

The Mount Selman Formation, which is the youngest formation of Eocene age in the county, crops out in the extreme southeastern part. It has a sandy surface and, below this, clay and thin beds of sandstone. The soils that formed in this material are of the Poth series, which are common in areas underlain by this formation.

Uvalde Gravel, the only formation of Pliocene age, is the oldest and the highest of the terrace deposits in Medina County. It consists of remnants that cap the hills and form stream divides. Its origin was mainly outwash derived from Edwards Limestone. Uvalde Gravel consists of coarse, rounded, flint pebbles and boulders and some limestone pebbles. The gravel is generally cemented with caliche. This formation ranges from a thin film on the surface to nearly 20 feet in thickness. The gravel and caliche are mined for road-surfacing material. The soils that formed in this material are those of the Devine, Hindes, Quihi, and Yologo series.

Leona Formation, the only formation of Pleistocene age, consists of deposits that make up broad terraces in the valleys of present streams and are lower than the terraces made up of Uvalde Gravel. The terraces are several hundred feet to 3 to 4 miles long on one or both sides of the major streams. This formation ranges from a mere film to 80 feet in thickness. Generally, it is thickest near the present stream channels or older abandoned meander channels. Among the soils that formed in the clay part are those of the Mercedes, Victoria, and Knippa series, and those that formed in the silty and sandy parts are of the Castroville and Atco series.

In Recent time, alluvium has also been deposited on the flood plains along present stream channels. Soils of the Divot series formed in the more clayey areas of this alluvium, and those of the Orif series in the more gravelly areas.

Additional Facts About the County

Medina County was created by separation from Bexar County in 1848. It was first settled in 1842 when about 700 immigrants settled in Castroville. By 1848, settlement of the communities of Quihi, New Fountain, Vandenburg, and D'Hanis had begun. In 1881, the railroad was built through this territory. In 1892, Hondo was made the county seat. By 1970 the population had increased from 18,904 in 1960 to 20,249.

The leading enterprise is agriculture, which includes the raising of livestock; the growing of peanuts, pecans, and hay; and the production of eggs and milk.

Among the farm-related industries are a peanut processing plant, a cotton gin, grain storage, a plant nursery in Devine, and a pecan products plant at Yancey. At Hondo, grain is stored, hothouse tomatoes are grown, and a soil conditioner is manufactured. Three cattle feedlots that have a total capacity of about 10,000 head are in the county; the largest one is near Devine, another is near D'Hanis, and a small one is near Hondo. A state fish hatchery is near Natalia.

Among the industries that are not farm related but that use natural resources of the county are a brick manufacturing plant at D'Hanis; six oil-and-gas fields; concrete mixing plants at Hondo, Devine, and LaCoste; and the mining of building sand, gravel, clay, and caliche. A large amount of coal has been mined and much remains, but none is being mined currently.

Among the other industries are an aircraft repair plant, a bathroom fixture plant, a carpet-padding plant, a Weather Service radar observatory, and an Air Force flight training school. All of these facilities are at Hondo. In addition, there are two car-testing tracks and a tire-test fleet.

Relief and Drainage

Relief in Medina County ranges from nearly level to steep. The northern part of the county is rough or hilly and locally is called "hill country." Large areas in the central part of the county and scattered areas throughout the rest of the county are nearly level. In the southern part of the county are rolling areas, and between these rolling areas and the nearly level areas are undulating areas. Also, between the nearly level areas and the hilly areas are scattered areas of rolling land.

Elevation ranges from 560 feet in the southeastern corner of the county to 2,030 feet in the northwestern corner *(3)*. In general, surface water in Medina County drains to the south and southeast. Squirrel Creek, Seco Creek, Hondo Creek, Verde Creek, and Quihi Creek are the principal streams that drain the northern and western part of the county. These are intermittent streams that are fed by springs in the Edwards Plateau and that flow south into the Frio River outside the county. The northern and eastern parts of the county are drained by the Medina River, which Isis the only perennial stream in the county and which empties into the San Antonio River. For 8 to 10 miles in the southern part, however, Hondo Creek also has a perennial flow. Most of the southeastern part of the county is drained by Black Creek, San Francisco Perez Creek, and Chacon Creek, which flow into the Frio River outside the county. A small area in the southeastern corner drains into the Atascosa River.

Most of the irrigation water in Medina County comes from deep wells drilled into Edwards Limestone Formation, but in the southern part of the county some wells obtain water from Carrizo Sand and the Indio Formation. In the southeastern corner of the county, about 18,000 acres receive irrigation water by canal from Medina Lake. The communities of Hondo, D'Hanis, Castroville, and LaCoste depend on water obtained from the Edwards Formation, which is at a depth of about 2,000 feet in the southern part of the county. The communities of Devine and Natalia obtain their water mainly from Carrizo Sand. In the northern part ponds, springs, and shallow wells drilled mainly into the Glen Rose Formation supply the water. In all the groundwater reservoirs, some of the wells are artesian.

Climate

By Robert B. Orton, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

The climate of Medina County is subtropical and characterized by dry winters and hot humid summers. It is essentially monsoonal in character; the prevailing wind circulation during the warm season is reversed during the cool season. Northerly winds predominate from November through February because of the influence of polar continental air masses, but southeasterly winds are persistent from April through September because tropical maritime air masses from the Gulf of Mexico control the weather. The weather in March to May and in September to November is pleasant. In September it is warm, but the temperatures are not so hot as in August. In October and November the days are mild and sunny and the nights crisp and cool.

Temperature and precipitation data for Medina County are given in table 9.

The average annual rainfall at Hondo is 28.46 inches, but both monthly and annual rainfall are quite variable. The heaviest amounts of rain fall from April through June and from September through October. Midsummer is relatively dry. A total of 58.73 inches fell at Hondo in 1935, the wettest year of record, and 11.92 inches fell in 1954, the driest year.

In Medina County winters are pleasantly mild. Cool spells are brief, and temperatures are freezing or below only on about one-third of the nights in winter. Freezing temperatures, if any, most often occur an hour or two before sunrise. The lowest temperature of record at Hondo was 4°F in 1949.

Summer weather is consistently hot, but low humidity in the afternoon helps to alleviate the heat. The evaporative type of home air conditioner is effective for cooling about 90 percent of the time during July and August, and the air conditioning of automobiles is common. The highest temperature of record at Hondo was 112° in 1939.

The mean length of the warm season (freeze-free period) is 263 days. The mean date of the last temperature of 32° or below in spring is March 6, and the first in fall is November 24.

Medina County receives approximately 54 percent of the total possible sunshine in winter, 60 percent in spring, 75 percent in summer, and 67 percent in fall.

Relative humidity, at noon, averages 58 percent in January, 56 percent in April, 48 percent in July, and 55 percent in October.

In an average year, evaporation exceeds precipitation by 36 inches; mean annual free water (lake) evaporation is 62 inches.

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Glossary

[Asterisks indicate terms used in tables 4 and 6]

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, sub humid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

***Compressible.** Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger. Sticky—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

***Depth to rock.** Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant' periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil some-what slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rain-fall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

***Excess lime.** Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

***Fast intake.** The rapid movement of water into the soil.

***Favorable.** Favorable soil features for the specified use.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine earth. Soil fraction having particles less than 2 millimeters in diameter.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused *(1)* by accumulation of clay, sesquioxides, humus, or a combination of these; *(2)* by prismatic or blocky structure; *(3)* by redder or browner colors than those in the A horizon; or *(4)* by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bed-rock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops. Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

***Large stones.** Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

***Percs slowly.** The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

***Piping.** Formation by moving water of subsurface tunnels or pipelike cavities.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

***Rooting depth.** Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

***Seepage.** The rapid movement of water through the soil. Seepage adversely affects the specified use.

***Shrink-swell.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

***Small stones.** Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: very coarse sand (2.0 millimeters to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.005 to 0.002 millimeter); and clay (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

***Thin layer.** Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

- Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
- Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.
- Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

The tables in this soil survey contain information that affects land use planning in this survey area. Current data tables may be available within the Web Soil Survey.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Amphion clay loam, 0 to 1 percent slopes	14,700	1.7
Amphion clay loam, 1 to 3 percent slopes	2,600	.3
Atco loam, 0 to 1 percent slopes	16,300	1.9
Atco loam, 1 to 3 percent slopes	9,900	1.1
Austin silty clay, 1 to 5 percent slopes	1,900	.2
Brackett association, undulating	10,600	1.2
Brackett-Rock outcrop association, hilly	8,900	1.0
Caid sandy clay loam, 0 to 1 percent slopes	3,800	.4
Caid sandy clay loam, 1 to 3 percent slopes	5,400	.6
Caid sandy clay loam, 3 to 5 percent slopes	1,100	.1
Castroville clay loam, 0 to 1 percent slopes	37,200	4.3
Castroville clay loam, 1 to 3 percent slopes	19,100	2.2
Devine association, undulating	4,700	.5
Dina association, gently undulating	6,800	.8
Divot clay loam	21,800	2.5
Divot clay loam, frequently flooded	3,000	.4
Doss association, gently undulating	2,500	.3
Duval fine sandy loam, 0 to 1 percent slopes	3,200	.4
Duval fine sandy loam, 1 to 3 percent slopes	18,000	2.1
Duval loamy fine sand, 0 to 5 percent slopes	13,000	1.5
Hanis sandy clay loam, 0 to 1 percent slopes	7,500	.9
Hanis sandy clay loam, 1 to 3 percent slopes	9,300	1.1
Hindes association, gently undulating	8,600	1.0
Kavett-Tarrant association, undulating	3,000	.3
Kincheloe soils, 10 to 30 percent slopes	4,600	.5
Knippa clay, 0 to 1 percent slopes	47,500	5.5
Knippa clay, 1 to 3 percent slopes	12,500	1.4
Lacoste soils, 1 to 5 percent slopes	5,400	.6
Mercedes clay, 0 to 1 percent slopes	40,600	4.7
Mercedes clay, 1 to 3 percent slopes	9,900	1.1
Mereta clay, 1 to 3 percent slopes	12,000	1.4
Miguel fine sandy loam, 0 to 1 percent slopes	12,500	1.4
Miguel fine sandy loam, 1 to 3 percent slopes	3,300	.4
Miguel soils, 0 to 1 percent slopes	1,900	.2
Monteola clay, 1 to 5 percent slopes	15,200	1.8
Monteola gravelly clay, 1 to 5 percent slopes	21,800	2.5
Nueces soils, 0 to 5 percent slopes	15,000	1.7
Olmos association, undulating	37,500	4.3
Olmos complex, 1 to 8 percent slopes	4,200	.5
Orif complex	3,000	.4
Patilo-Eufaula association, gently undulating	15,300	1.8
Poth loamy fine sand, 0 to 3 percent slopes	6,800	.8
Pratley clay, 0 to 3 percent slopes	17,600	2.0
Quihi association, gently undulating	21,000	2.4
Quihi and Devine soils, 1 to 8 percent slopes	800	.1
Real association, undulating	30,400	3.5
Real and Brackett soils, 1 to 8 percent slopes	1,000	.1
Rehm complex, 1 to 8 percent slopes	10,500	1.2
Sabenyo clay loam, 1 to 5 percent slopes	5,800	.7
Speck association, undulating	46,300	5.3
Tarrant-Rock outcrop association, undulating	55,700	6.4
Tarrant-Rock outcrop association, hilly	47,000	5.4
Tarrant-Rock outcrop-Brackett association, steep	18,000	2.1
Tarrant and Speck soils, 1 to 8 percent slopes	1,700	.2
Tiocano clay	1,800	.2
Topia clay, 0 to 2 percent slopes	3,000	.4
Valco clay loam, 0 to 2 percent slopes	10,100	1.2
Victoria clay, 0 to 1 percent slopes	31,500	3.6
Webb fine sandy loam, 0 to 1 percent slopes	4,400	.5
Webb fine sandy loam, 1 to 3 percent slopes	11,600	1.3
Webb fine sandy loam, 3 to 5 percent slopes	800	.1
Wilco loamy fine sand, 0 to 3 percent slopes	8,700	1.0
Yologo association, undulating	29,300	3.4
Yologo and Hindes soils, 1 to 8 percent slopes	1,700	.2
Total land area	860,600	99.1
Stream beds and water areas	7,880	.9
Total county area	868,480	100.0

TABLE 2.—*Predicted average yields per acre of principal irrigated and dryland crops*

[Dashes indicate that the soil is not suited to the crop specified]

Soil	Irrigated					Irrigated—Continued		Dryland				
	Grain sorghum	Corn	Onions	Cabbage	Carrots	Improved bermuda-grass	Peanuts	Grain sorghum	Oats [1]	Corn	Peanuts	Improved bermuda-grass
	Lb	*Bu*	*50-lb. bag*	*Tons*	*Tons*	*AUM* [2]	*Lb*	*Lb*	*Bu*	*Bu*	*Lb*	*AUM* [2]
Amphion clay loam, 0 to 1 percent slopes	7,500	120	800	18	15	18	---	3,000	55	40	---	3.5
Amphion clay loam, 1 to 3 percent slopes	6,500	110	700	16	14	16	---	2,750	45	35	---	3.0
Atco loam, 0 to 1 percent slopes	5,000	80	700	12	10	14	---	1,750	40	35	---	3.5
Atco loam, 1 to 3 percent slopes	4,500	---	625	10	10	14	---	1,500	35	30	---	3.0
Austin silty clay, 1 to 5 percent slopes	4,500	80	---	---	---	16	---	3,000	45	---	---	4.0
Caid sandy clay loam, 0 to 1 percent slopes	6,000	110	650	15	13	18	---	2,500	40	30	---	3.5
Caid sandy clay loam, 1 to 3 percent slopes	4,500	100	650	12	10	16	---	2,250	35	25	---	3.0
Caid sandy clay loam, 3 to 5 percent slopes	4,000	85	500	8	7	14	---	2,000	30	20	---	2.5
Castroville clay loam, 0 to 1 percent slopes	7,000	120	700	18	12	18	---	3,000	60	40	---	4.5
Castroville clay loam, 1 to 3 percent slopes	6,500	100	650	15	11	16	---	2,750	55	35	---	4.0
Divot clay loam	7,500	125	800	18	15	16	---	3,000	60	40	---	6.0
Divot clay loam, frequently flooded	---	---	---	---	---	18	---	---	---	---	---	5.0
Doss association, gently undulating	3,000	---	---	---	---	14	---	2,000	50	---	---	3.5
Duval fine sandy loam, 0 to 1 percent slopes	5,500	110	750	13	15	13	3,500	2,500	55	---	1,200	3.5
Duval fine sandy loam, 1 to 3 percent slopes	5,000	100	650	11	13	11	3,000	2,250	50	---	1,000	3.0
Duval loamy fine sand, 0 to 5 percent slopes	5,000	---	---	---	---	10	2,800	2,250	45	---	1,050	3.0
Hanis sandy clay loam, 0 to 1 percent slopes	7,500	120	800	18	15	18	---	3,500	40	35	---	4.5
Hanis sandy clay loam, 1 to 3 percent slopes	6,500	110	700	16	14	16	---	3,000	35	30	---	4.0
Knippa clay, 0 to 1 percent slopes	7,000	120	700	18	12	18	---	3,000	50	40	---	4.0
Knippa clay, 1 to 3 percent slopes	6,000	110	600	14	10	16	---	2,500	45	35	---	3.5
Lacoste soils, 1 to 5 percent slopes	3,500	65	500	9	8	14	---	1,750	30	---	---	2.5
Mercedes clay, 0 to 1 percent slopes	7,000	120	800	16	12	18	---	3,000	50	40	---	6.0
Mercedes clay, 1 to 3 percent slopes	5,000	105	600	13	9	16	---	2,500	45	35	---	5.5
Mereta clay, 1 to 3 percent slopes	3,000	---	---	---	---	13	---	1,500	45	---	---	2.5
Miguel fine sandy loam, 0 to 1 percent slopes	5,000	85	600	---	10	18	3,500	2,000	35	30	---	3.0
Miguel fine sandy loam, 1 to 3 percent slopes	4,000	75	500	---	9	16	3,000	1,750	30	25	---	2.5
Miguel soils, 0 to 1 percent slopes	5,500	---	---	---	---	18	3,500	2,000	40	---	---	3.5
Monteola clay, 1 to 5 percent slopes	6,000	100	600	14	---	16	---	3,000	40	40	---	5.0
Monteola gravelly clay, 1 to 5 percent slopes	5,500	90	---	---	---	16	---	3,000	40	35	---	4.0
Nueces soils, 0 to 5 percent slopes	3,500	---	---	---	---	10	3,000	2,000	35	---	1,000	4.0
Patilo-Eufaula association, gently undulating	---	---	---	---	---	10	2,500	1,500	---	---	1,000	4.0
Poth loamy fine sand, 0 to 3 percent slopes	5,000	---	---	---	---	10	3,500	2,250	40	25	1,250	5.0
Pratley clay, 0 to 3 percent slopes	5,500	95	---	---	---	14	---	2,500	40	---	---	4.0
Quihi association, gently undulating	---	---	---	---	---	---	---	1,500	30	---	---	3.0
Sabenyo clay loam, 1 to 5 percent slopes	3,000	---	---	---	---	12	---	1,250	30	---	---	2.5
Topia clay, 0 to 2 percent slopes	5,000	---	---	---	---	14	---	2,000	35	---	---	3.0
Valco clay loam, 0 to 2 percent slopes	3,000	60	450	8	7	13	---	1,500	35	---	---	2.5
Victoria clay, 0 to 1 percent slopes	7,000	120	800	16	---	18	---	3,500	50	40	---	6.5
Webb fine sandy loam, 0 to 1 percent slopes	6,000	90	700	---	12	18	3,500	2,500	50	35	900	3.0
Webb fine sandy loam, 1 to 3 percent slopes	5,500	80	---	---	---	16	3,000	2,250	45	30	800	2.5
Webb fine sandy loam, 3 to 5 percent slopes	4,500	70	---	---	---	14	2,500	2,000	40	30	600	2.0
Wilco loamy fine sand, 0 to 3 percent slopes	5,000	---	700	---	---	12	3,500	2,500	40	25	1,000	5.0

[1] Not grazed.

[2] AUM is animal-unit-months, a term used to express the carrying capacity of pasture. It is the number of months during the year that 1 acre will provide grazing for 1 animal unit (1 cow, 1 horse, 1 mule, 5 hogs, or 7 sheep) without damage to the pasture.

TABLE 3.—*Soil ratings for elements of wildlife habitat and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat					
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Trees and shrubs	Openland wildlife	Range wildlife
Amphion: AmA, AmB	Good	Good	Fair	Good	Good	Fair.
Atco: AtA, AtB	Fair	Fair	Good	Good	Fair	Good.
Austin: AuC	Good	Good	Poor	Fair	Fair	Poor.
Brackett: BKD, BRF	Poor	Poor	Fair	Poor	Poor	Poor.
For the Rock outcrop part of BRF, see Rock outcrop.						
Caid: CdA, CdB, CdC	Fair	Fair	Fair	Fair	Fair	Fair.
Castroville: CsA, CsB	Good	Good	Fair	Good	Good	Fair.
Devine: DED	Poor	Poor	Fair	Good	Poor	Fair.
Dina: DNC	Poor	Poor	Fair	Fair	Poor	Fair.
Divot:						
Do	Good	Good	Fair	Good	Good	Fair.
Dp	Very poor	Poor	Fair	Good	Poor	Fair.
Doss: DSC	Poor	Poor	Fair	Fair	Poor	Fair.
Duval: DuA, DuB, DwC	Fair	Good	Fair	Good	Fair	Fair.
Eufaula	Poor	Poor	Fair	Fair	Poor	Fair.
Mapped only in an association with Patilo soils.						
Hanis: HaA, HaB	Good	Good	Fair	Good	Good	Fair.
Hindes: HNC	Poor	Poor	Fair	Fair	Poor	Fair.
Kavett: KAD	Fair	Good	Fair	Fair	Fair	Fair.
For the Tarrant part, see the Tarrant series.						
Kincheloe: KcF	Poor	Fair	Poor	Fair	Poor	Poor.
Knippa: KnA, KnB	Good	Good	Fair	Fair	Good	Fair.
Lacoste: LaC	Poor	Poor	Fair	Fair	Poor	Fair.
Mercedes: McA, McB	Good	Good	Poor	Poor	Fair	Poor.
Mereta: MeB	Fair	Fair	Fair	Poor	Fair	Poor.
Miguel: MgA, MgB, MhA	Fair	Fair	Good	Good	Fair	Good.
Monteola: MnC, MoC	Fair	Good	Poor	Poor	Fair	Poor.
Nueces: NuC	Fair	Fair	Fair	Good	Fair	Fair.
Olmos: OmD, OND	Very poor	Very poor	Poor	Poor	Very poor	Poor.
Orif: Or	Very poor	Poor	Fair	Fair	Poor	Fair.
Patilo: PEC	Fair	Fair	Fair	Good	Fair	Fair.
For the Eufaula part, see the Eufaula series.						
Poth: PoB	Fair	Good	Good	Good	Good	Good.
Pratley: PrB	Good	Good	Poor	Poor	Fair	Poor.
Quihi: QUC, QvD	Poor	Poor	Fair	Fair	Poor	Fair.
For the Devine part of QvD, see the Devine series.						
Real: RED, RkD	Poor	Poor	Poor	Poor	Poor	Poor.
For the Brackett part of RkD, see the Brackett series.						
Rehm: RmD	Poor	Poor	Fair	Fair	Poor	Fair.
Rock outcrop	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Mapped only in association with Tarrant and Brackett soils.						
Sabenyo: SaC	Fair	Good	Good	Good	Good	Good.
Speck: SPD	Fair	Fair	Fair	Fair	Fair	Fair.
Tarrant: TAD, TAF, TBG, TeD	Very poor	Very poor	Fair	Fair	Very poor	Fair.
For the Rock outcrop part of TAD, TAF, and TBG, see Rock outcrop. For the Brackett part of TBG, see the Brackett series. For the Speck part of TeD, see the Speck series.						
Tiocano: To	Poor	Poor	Poor	Fair	Poor	Poor.
Topia: TpB	Fair	Fair	Fair	Fair	Fair	Fair.
Valco: VaB	Poor	Poor	Fair	Fair	Poor	Fair.
Victoria: VcA	Good	Good	Poor	Fair	Fair	Poor.
Webb: WbA, WbB, WbC	Fair	Good	Fair	Good	Fair	Fair.
Wilco: WoB	Fair	Fair	Good	Good	Fair	Good.
Yologo: YOD, YsD	Very poor	Very poor	Poor	Fair	Very poor	Poor.
For the Hindes part of YsD, see the Hindes series.						

TABLE 4.—*Soil interpretations for recreation use*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil series and map symbols	Degree and kinds of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trials
Amphion: AmA, AmB	Moderate: percs slowly; too clayey.	Moderate: too clayey	Moderate: percs slowly; too clayey.	Moderate: too clayey.
Atco: AtA, AtB	Moderate: dusty	Moderate: dusty	Moderate: dusty; slope	Slight.
Austin: AuC	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Brackett:				
BKD	Moderate: percs slowly	Slight	Moderate: percs slowly	Slight.
BRF	Severe: slope	Severe: slope	Severe: slope	Slight.
Rock outcrop part is too variable to be rated.				
Caid: CdA, CdB, CdC	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey; slope.	Moderate: too clayey.
Castroville: CsA, CsB	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey.
Devine: DED	Moderate: percs slowly; small stones.	Moderate: small stones	Severe: small stones	Moderate: small stones.
Dina: DNC	Moderate: percs slowly; small stones.	Moderate: too clayey; small stones.	Severe: small stones	Moderate: small stones.
Divot: Do, Dp	Severe: floods	Moderate: floods; too clayey.	Moderate: floods; too clayey.	Moderate: too clayey.
Doss: DSC	Severe: too clayey	Severe: too clayey	Severe: percs slowly; too clayey.	Severe: too clayey.
Duval:				
DuA, DuB	Slight	Slight	Slight	Slight.
DwC	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy	Moderate: too sandy.
Eufaula	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Mapped only in an association with Patilo soils.				
Hanis: HaA, HaB	Moderate: percs slowly; too clayey.	Moderate: too clayey	Moderate: percs slowly; too clayey.	Moderate: too clayey.
Hindes: HNC	Moderate: percs slowly; small stones.	Moderate: too clayey; small stones.	Moderate: percs slowly; small stones.	Moderate: too clayey; small stones.
Kavett: KAD	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
For the Tarrant part, see the Tarrant series.				
Kincheloe: KcF	Severe: percs slowly; too clayey; slope.	Severe: too clayey; slope	Severe: percs slowly; too clayey; slope.	Severe: too clayey.
Knippa: KnA, KnB	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Lacoste: LaC	Slight	Slight	Moderate: slope	Slight.
Mercedes: McA, McB	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; too clayey.	Severe: too clayey.
Mereta: MeB	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Miguel: MgA, MgB, MhA	Moderate: percs slowly	Slight	Moderate: percs slowly	Slight.
Monteola: MnC, MoC	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; too clayey.	Severe: too clayey.
Nueces: NuC	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Olmos: OmD, OND	Moderate: small stones	Moderate: small stones	Severe: depth to rock	Moderate: small stones.
Orif: Or	Severe: floods	Moderate: floods	Severe: floods	Moderate: floods.
Patilo: PEC	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
For the Eufaula part, see the Eufaula series.				
Poth: PoB	Moderate: percs slowly; too sandy.	Moderate: too sandy	Moderate: percs slowly; too sandy.	Moderate: too sandy.
Pratley: PrB	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Quihi: QUC, QvD	Moderate: percs slowly; too clayey.	Moderate: too clayey	Severe: small stones	Moderate: too clayey.
For the Devine part of QvD, see the Devine series.				
Real: RED, RkD	Moderate: too clayey; small stones.	Moderate: too clayey; small stones.	Severe: depth to rock; slopes; small stones.	Moderate: too clayey; small stones.
For the Brackett part of RkD, see Brackett series.				
Rehm: RmD	Moderate: too clayey; small stones.	Moderate: too clayey; small stones.	Moderate: too clayey; small stones.	Moderate: too clayey; small stones.
Sabenyo: SaC	Moderate: too clayey	Moderate: too clayey	Moderate: too clayey; slopes.	Moderate: too clayey.
Speck: SPD	Moderate: percs slowly; too clayey.	Moderate: too clayey	Severe: depth to rock	Moderate: too clayey.
Tarrant: TAD, TAF, TBG, TeD	Severe: too clayey; large stones.	Severe: too clayey; large stones.	Severe: too clayey; large stones, slope.	Severe: too clayey; large stones.
For the Brackett part of TBG and Speck part of TeD, see Brackett and Speck series. The Rock outcrop part of TAD, TAF, TBG, is too variable to be rated.				
Tiocano: To	Severe: too clayey; percs slowly; floods.	Severe: too clayey; floods	Severe: too clayey; percs slowly; floods.	Severe: too clayey, floods.
Topia: TpB	Severe: too clayey; percs slowly.	Severe: too clayey	Severe: too clayey, percs slowly.	Severe: too clayey.
Valco: VaB	Moderate: too clayey	Moderate: too clayey	Severe: depth to rock	Moderate: too clayey.
Victoria: VcA	Severe: too clayey; percs slowly.	Severe: too clayey	Severe: too clayey; percs slowly.	Severe: too clayey.
Webb: WbA, WbB, WbC	Moderate: percs slowly	Slight	Moderate: percs slowly	Slight.
Wilco: WoB	Moderate: percs slowly; too sandy.	Moderate: too sandy	Moderate: percs slowly; too sandy.	Moderate: too sandy.
Yologo: YOD, YsD	Moderate: small stones	Moderate: small stones	Severe: depth to rock	Moderate: small stones.
For the Hindes part of YsD, see the Hindes series.				

TABLE 5.—*Estimates of soil properties significant in engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units can have different properties, and for this reason it is necessary to refer to other series as indicated in the first column of this table. The symbol > means more than; the symbol < means less than]

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Shrink-swell potential	USDA texture	Classification		Coarse fraction larger than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Corrosivity	
						Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
		Inches	*Inches*					*Percent*					*Percent*		*Inches per hour*	*Inches per inch of soil*	*pH*		
Amphion: AmA, AmB	C	>60	0–10	Moderate	Clay loam	CL	A–6	---	100	100	100	55–65	25–35	11–20	0.6–2.0	0.15–0.20	6.6–7.8	High	Low.
			10–68	Moderate	Clay, clay loam, or sandy clay.	CL	A–6 or A–7	---	95–100	95–100	90–100	60–75	30–50	15–30	0.2–0.6	0.12–0.16	7.4–8.4	High	Low.
			68–80	Moderate	Clay, clay loam, sandy clay loam.	CL	A–6	---	90–100	90–100	85–95	50–65	30–40	15–25	0.2–0.6	0.12–0.16	7.9–8.4	High	Low.
Atco: AtA, AtB	B	>60	0–9	Low	Loam	CL	A–4 or A–6	---	95–100	95–100	95–100	60–70	25–35	8–16	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.
			9–126	Low	Clay loam, sandy clay loam, loam.	CL	A–4 or A–6	---	100	100	95–100	65–75	25–35	8–16	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.
Austin: AuC	C	20–40	0–35	High	Silty clay	CH or CL	A–7–6	0–5	95–100	95–100	80–90	75–90	45–65	25–40	0.2–0.6	0.15–0.18	7.9–8.4	High	Low.
			35–60		Chalk and marl.														
Brackett: BKD, BRF. Properties of the Rock outcrop part of BRF are too variable to be estimated.	C	10–20	0–14	Low	Loam, clay loam	CL or SC	A–6	10–20	70–100	65–100	55–95	40–85	30–40	11–20	0.2–0.6	0.10–0.15	7.9–8.4	High	Low.
			14–41		Marl interbedded with platy limestone.														
Caid: CdA, CdB, CdC	B	>60	0–13	Low	Sandy clay loam	CL or SC	A–6	---	98–100	98–100	80–98	45–55	25–35	11–20	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.
			13–84	Low	Clay loam, sandy clay loam.	CL	A–6	---	95–100	95–100	85–97	55–75	30–40	15–25	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.
Castroville: CsA, CsB	B	>60	0–16	Moderate	Clay loam	CL	A–7–6	---	98–100	95–100	90–100	80–90	41–50	20–30	0.6–2.0	0.15–0.20	7.9–8.4	High	Low.
			16–84	Moderate	Clay, clay loam, or silty clay.	CL	A–6 or A–7–6	---	85–100	80–100	80–100	70–90	30–45	14–25	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.
Devine: DED. Mapped only with Quihi series.	C	>60	0–38	Very low	Gravelly sandy loam, very gravelly sandy loam, gravelly loam, or very gravelly loam.	GM, GP–GM or SP–SM	A–1	0–5	20–55	10–50	10–40	8–25	---	[1] NP	6.0–20.0	0.07–0.11	5.6–7.3	Low	Low.
			38–88	Low	Gravelly or very gravelly clay loam, clay, or sandy clay.	GC	A–2	5–10	20–55	15–45	15–40	15–35	35–50	18–30	0.2–0.6	0.05–0.10	5.6–7.8	Low	Low.
			88–98	Moderate	Sandy clay loam, clay, or clay loam.	SC or CL	A–6	0–2	90–100	90–100	80–90	36–55	25–35	11–20	0.6–2.0	0.10–0.20	5.6–7.8	Moderate	Low.
			98–12(		Weakly consolidated sandstone.														
Dina: DNC	C	21–40	0–11	Low	Gravelly loam, silt loam, or clay loam.	GC, SC, CL	A–2–7 or A–6, A–2–6, A–7	3–20	40–95	35–95	30–95	13–55	30–45	11–25	0.6–2.0	0.05–0.11	5.6–7.8	High	Low.
			11–31	Low	Very gravelly clay or gravelly clay.	GC, SC, GP–GC	A–2–7 or A–6 or A–7, A–2–6	3–20	15–70	5–50	5–50	5–49	38–75	18–50	0.2–0.6	0.05–0.10	5.6–7.8	High	Low.
			31–48		Indurated limestone bedrock.														
Divot: Do, Dp	C	>60	0–94	High	Clay loam, clay	CL or CH	A–7–6	0–5	85–100	75–100	75–100	70–95	41–55	20–30	0.2–0.6	0.15–0.20	7.4–8.4	High	Low.
Doss: DSC	C	11–20	0–18	High	Silty clay, silty clay loam, clay loam, clay.	CH	A–7	0–15	90–100	90–100	90–100	90–95	51–70	30–50	0.2–0.6	0.15–0.20	7.9–8.4	Moderate	Low.
			18		Weakly cemented limestone.														
Duval: DuA, DuB, DwC	B	40–60	0–10	Low	Fine sandy loam and loamy fine sand.	SM or SC, SM–SC	A–2–4	---	98–100	98–100	90–100	15–25	<25	NP–10	0.6–2.0	0.10–0.15	6.1–7.3	High	Low.

See footnote at end of table.

TABLE 5.—*Estimates of soil properties significant in engineering*—Continued

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Shrink-swell potential	USDA texture	Classification		Coarse fraction larger than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Corrosivity	
						Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 0.074 mm)						Uncoated steel	Concrete
		Inches	*Inches*					*Percent*					*Percent*		*Inches per hour*	*Inches per inch of soil*	*pH*		
			10–50	Low	Sandy clay loam, sandy loam.	SC, SM-SC	A-6 or A-4	---	98–100	98–100	90–100	36–45	20–35	7–15	0.6–2.0	0.11–0.17	6.1–7.8	High	Low.
			50–65		Weakly consolidated sandstone.														
Eufaula Mapped only in an association with Patilo soils.	A	>60	0–110	Low	Fine sand	SM	A-2-4	---	100	100	85–95	12–15	---	NP	6.0–20.0	0.05–0.08	5.1–7.3	Low	Moderate.
Hanis: HaA, HaB	C	>60	0–9	Moderate	Sandy clay loam	SC or CL	A-6, A-4	0–5	95–100	95–100	85–100	40–65	20–35	8–16	0.6–2.0	0.13–0.20	6.1–7.8	High	Low.
			9–37	Moderate	Sandy clay or clay.	CL	A-6 or A-7-6	0–5	95–100	95–100	85–100	51–75	38–49	20–30	0.2–0.6	0.13–0.18	6.1–8.4	High	Low.
			37–72	Moderate	Sandy clay loam, or sandy clay.	SC or CL	A-6 or A-7-6	0–5	84–100	70–90	65–85	45–65	30–45	15–25	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.
Hindes: HNC	C	>60	0–4	Low	Gravelly sandy clay loam, loam, clay loam, fine sandy loam.	GC or SC	A-4 or A-6	0–5	50–95	50–95	45–75	36–49	22–35	8–15	0.6–2.0	0.10–0.15	6.1–7.8	Moderate	Low.
			4–30	Moderate	Very gravelly or gravelly clay or clay loam.	GC or SC	A-2 or A-6, A-7	5–10	20–70	20–65	20–60	20–49	35–45	15–25	0.2–0.6	0.05–0.10	6.1–7.8	High	Low.
			30–40		Weakly cemented caliche.														
*Kavett: KAD For the Tarrant part, see the Tarrant series.	D	11–20	0–14	High	Clay, silty clay	CH	A-7-6	0–5	90–100	90–100	85–100	80–95	51–60	25–35	0.2–0.6	0.15–0.20	7.9–8.4	High	Low.
			14–20		Indurated caliche and limestone.														
Kincheloe: KcF	D	20–40	0–24	High	Clay or clay loam.	CH, CL	A-7-6	0–15	95–100	95–100	90–100	75–95	41–60	22–35	<0.06	0.13–0.17	7.8–8.4	High	Low.
			24–72	High	Clayey shale	CH or CL	A-6 or A-7-6	0–5	90–100	85–100	65–90	55–90	35–55	15–35	<0.06	0.08–0.12	7.9–8.4	High	Low.
Knippa: KnA, KnB	C	>60	0–80	High	Clay, silty clay, clay loam.	CH or CL	A-7-6	---	90–100	85–100	80–95	75–95	45–65	25–40	0.2–0.6	0.15–0.20	7.9–8.4	High	Low.
Lacoste: LaC	C	10–20	0–9	Very low	Fine sandy loam or loamy fine sand.	SM or SM-SC	A-2-4 or A-4	0–5	80–100	85–100	65–85	30–45	15–25	2–7	0.6–2.0	0.10–0.15	6.6–8.4	Moderate	Low.
			9–17	Low	Sandy clay loam, fine sandy loam.	SC or CL	A-2-4, A-4, A-6, or A-2-6	0–5	75–100	75–100	70–90	30–55	20–30	9–15	0.6–2.0	0.10–0.15	6.6–8.4	Moderate	Low.
			17–68		Strongly to weakly cemented caliche.														
Mercedes: McA, McB	D	>60	0–66	Very high	Clay	CH	A-7-6	---	95–100	95–100	90–100	75–95	60–80	45–55	<0.06	0.13–0.18	7.9–8.4	High	Low.
Mereta: MeB	C	14–20	0–17	Moderate	Clay	CL	A-6 or A-7-6	---	95–100	90–100	80–90	65–80	35–45	20–30	0.2–0.6	0.15–0.20	7.9–8.4	High	Low.
			17–24		Indurated to weakly cemented caliche.														
Miguel: MgA, MgB, MhA	D	>60	0–10	Low	Fine sandy loam, loamy fine sand.	SM or SM-SC	A-4, A-2-4	---	95–100	95–100	90–100	15–40	15–25	2–6	0.2–0.6	0.11–0.15	6.1–7.3	High	Low.
			10–35	Moderate	Clay, sandy clay.	CL or CH	A-6 or A-7-6	---	95–100	95–100	90–100	60–70	40–55	20–30	<0.06	0.15–0.17	6.6–7.8	High	Low.
			35–90	Moderate	Sandy clay or sandy clay loam.	SC, CL	A-6 or A-7-6	---	95–100	90–100	90–100	40–51	30–45	20–30	0.06–0.2	0.13–0.15	7.4–8.4	Moderate	Low.
Monteola: MnC, MoC	D	>60	0–56	Very high	Clay, gravelly clay.	CH	A-7-6	0–5	80–100	70–100	85–100	75–90	51–69	35–45	<0.06	0.15–0.20	7.9–8.4	High	Low.
			56–75		Shaley clay.														

See footnote at end of table.

TABLE 5.—*Estimates of soil properties significant in engineering*—Continued

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Shrink-swell potential	USDA texture	Classification		Coarse fraction larger than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Corrosivity	
						Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
		Inches	*Inches*					*Percent*					*Percent*		*Inches per hour*	*Inches per inch of soil*	*pH*		
Nueces: NuC	C	>60	0–34	Very low	Fine sand, loamy fine sand.	SM or SM-SC	A-2-4	---	100	100	90–100	20–35	<20	NP–6	6.0–20.0	0.05–0.08	6.1–7.3	Low	Low.
			34–42	Low	Sandy clay loam, fine sandy loam.	SC	A-2-6	---	90–100	90–100	80–90	20–30	25–40	12–20	0.2–0.6	0.12–0.16	6.6–8.4	Moderate	Low.
			42–84	Low	Sandy clay loam, fine sandy loam.	SC	A-6 or A-2-6	---	100	100	90–100	35–49	25–40	12–20	0.2–0.6	0.12–0.17	6.6–8.4	Moderate	Low.
Olmos: OmD, OND	C	7–20	0–14	Low	Gravelly or very gravelly clay loam.	GC or SC, GM-GC	A-2-6 or A-2-4	10–35	35–75	25–65	25–55	20–35	25–35	7–20	0.6–2.0	0.05–0.08	7.9–8.4	High	Low.
			14–16		Strongly and weakly cemented caliche.														
Orif: Or	A	>60	0–10	Very low	Loam, loamy fine sand.	SM, SC, SM-SC	A-2-4 or A-4, A-1	---	80–95	75–95	40–60	20–40	<20	NP–10	2.0–6.0	0.05–0.10	7.9–8.4	Moderate	Low.
			10–46	Very low	Very gravelly sand, very gravelly loamy sand.	SM or GM, GW, GP, SP	A-1	5–20	20–70	10–50	5–25	0–20	---	NP	6.0–20.0	0.02–0.05	7.9–8.4	Moderate	Low.
			46–84	Very low	Sand, loamy sand.	SM or SP-SM	A-1, A-2-4, or A-3	---	95–100	95–100	50–70	5–15	---	NP	6.0–20.0	0.02–0.06	7.9–8.4	Moderate	Low.
*Patilo: PEC. For the Eufaula part, see the Eufaula series.	C	>60	0–48	Very low	Fine sand, loamy fine sand.	SM, SP-SM	A-2-4, A-3	---	100	95–100	90–100	8–20	<20	NP–3	6.0–20.0	0.05–0.08	5.6–7.3	Low	Moderate.
			48–84	Low	Sandy clay loam.	SC	A-6 or A-2-6	---	90–100	90–100	90–100	24–49	20–35	11–20	0.2–0.6	0.14–0.18	5.1–6.5	Low	Moderate.
Poth: PoB	C	>60	0–26	Very low	Loamy fine sand.	SM or SM-SC	A-2-4	---	98–100	98–100	60–90	20–35	20–25	2–6	2.0–6.0	0.07–0.11	6.1–7.3	Low	Moderate.
			26–42	Moderate	Sandy clay, sandy clay loam.	SC or CL	A-6 or A-7-6	---	98–100	95–100	85–95	45–60	35–50	15–30	0.06–0.2	0.15–0.19	6.1–8.4	Moderate	Low.
			42–80	Low	Sandy clay loam.	SC or CL	A-4 or A-6	---	90–100	90–100	65–90	45–55	20–30	10–20	0.6–2.0	0.10–0.16	6.6–8.4	Moderate	Low.
Pratley: PrB	C	22–40	0–33	High	Clay	CH	A-7-6	0–5	95–100	95–100	80–95	80–90	51–60	25–35	0.2–0.6	0.15–0.20	6.6–8.4	High	Low.
			33		Indurated and weakly cemented caliche and limestone material.														
*Quihi: QUC, OvD. For the Devine part of OvD, see the Devine series.	C	20–40	0–9	Low	Gravelly clay loam or gravelly sandy clay loam, clay loam, or sandy clay loam.	CL or GC or SC	A-6 or A-7-6	0–15	50–90	40–90	50–75	36–70	30–49	11–27	0.6–2.0	0.10–0.15	6.1–7.8	High	Low.
			9–30	Low	Very gravelly clay or gravelly clay.	GC or SC or GP-GC or SP-SC	A-2-7 or A-7-6, A-7-5	0–15	16–60	10–50	10–50	10–45	45–85	22–50	0.2–0.6	0.02–0.08	6.1–8.4	High	Low.
			30–46		Strongly and weakly cemented caliche.														
*Real: RED, RkD. For the Brackett part of RkD, see the Brackett series.	D	8–20	0–13	Low	Gravelly or very gravelly loam or clay loam.	GC or SC	A-2-6	5–40	40–70	30–50	25–45	20–30	25–35	10–20	0.6–2.0	0.05–0.10	7.9–8.4	High	Low.
			13–20		Weakly cemented limestone.														
Rehm: RmD	C	30–60	0–11	Low	Gravelly clay loam or loam.	GC or SC	A-2-6 or A-6	0–5	60–85	50–85	40–75	30–49	30–40	15–22	0.6–2.0	0.10–0.15	7.9–8.4	High	Low.

See footnote at end of table.

TABLE 5.—*Estimates of soil properties significant in engineering*—Continued.

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Shrink-swell potential	USDA texture	Classification		Coarse fraction larger than 3 inches	Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Corrosivity	
						Unified	AASHTO		No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						Uncoated steel	Concrete
		Inches	*Inches*					*Percent*					*Percent*		*Inches per hour*	*Inches per inch of soil*	*pH*		
			11–44	Low	Very gravelly or gravelly loam or clay loam.	GC or SC	A–2–6 or A–6	5–10	25–70	20–65	20–60	20–49	30–40	15–22	0.6–2.0	0.05–.10	7.9–8.4	High	Low.
			44–96		Shaly clay or weakly consolidated sandstone.														
Rock outcrop: Properties are too variable to be estimated.																			
Sabenyo: SaC	B	>60	0–17	Low	Clay loam	CL or CL–ML	A–6, A–4	---	95–100	70–100	65–90	60–80	20–30	5–15	0.6–2.0	0.12–0.17	7.9–8.4	Moderate	Low.
			17–52	Low	Clay loam, loam.	CL or CL–ML	A–6, A–4	---	75–95	55–80	55–75	60–80	20–40	5–20	0.6–2.0	0.12–0.17	7.9–8.4	Moderate	Low.
			52–85	Low	Sandy clay loam, sandy loam.	SM–SC or CL–ML or SC or CL	A–4 or A–6	---	95–100	95–100	60–70	36–55	20–40	5–15	0.6–2.0	0.05–0.10	7.9–8.4	Moderate	Low.
Speck: SPD	D	14–20	0–7	Low	Clay loam or clay.	CL	A–7–6 or A–6	5–10	95–100	95–100	85–95	80–90	30–45	15–25	0.2–0.6	0.15–0.20	6.1–7.8	Moderate	Low.
			7–15	Moderate	Clay	CH or CL	A–7–6	0–5	75–95	75–95	75–95	60–95	45–55	25–35	0.06–0.2	0.15–0.20	6.1–7.8	High	Low.
			15–22		Fractured indurated limestone.														
*Tarrant: TAD, TAF, TBG, TeD. For the Brackett part of TBG, and for the Speck part of TeD, see those series. Properties of the Rock outcrop parts of TAD, TAF, and TBG are too variable to be estimated.	D	6–18	0–16	High	Cobbly clay, very cobbly clay or cobbly silty clay.	CH	A–7–5 or A–7–6	30–70	80–90	80–90	75–85	70–90	55–70	30–40	0.2–0.6	0.15–0.17	7.9–8.4	High	Low.
			16–24		Fractured indurated platy limestone.														
Tiocano: To	D	>60	0–60	High	Clay, silty clay	CH	A–7–6	---	100	100	100	70–100	51–70	30–55	<0.06	0.13–0.18	6.6–8.4	Very high	Low.
Topia: TpB	D	21–40	0–26	High	Clay	CH or CL	A–7–6	0–5	85–100	85–100	80–90	75–90	41–55	30–40	<0.06	0.15–0.20	6.1–8.4	High	Low.
			26–38	Moderate	Clay	CH or GC or SC or CL	A–7–6 or A–2–7	0–5	45–95	40–90	30–80	25–65	41–55	30–40	0.06–0.2	0.15–0.20	7.4–8.4	High	Low.
			38–48		Weakly consolidated limestone.														
Valco: VaB	C	10–20	0–16	Low	Clay loam	CL	A–6	0–15	90–95	85–90	70–80	55–70	27–37	11–20	0.6–2.0	0.15–0.18	7.9–8.4	High	Low.
			16–40		Strongly and weakly cemented caliche.														
Victoria: VcA	D	>60	0–70	Very High	Clay	CH	A–7–6	---	95–100	95–100	94–100	85–90	51–75	30–45	<0.06	0.18–0.20	7.9–8.4	Very high	Low.
Webb: WbA, WbB, WbC	C	>60	0–12	Low	Fine sandy loam.	SM or SM–SC	A–2–4	---	100	100	95–99	30–35	<20	NP–7	0.06–0.2	0.10–0.15	5.6–7.3	High	Low.
			12–43	Moderate	Sandy clay or sandy clay loam or fine sandy loam.	CL	A–6	---	100	95–100	95–99	55–80	28–40	11–22	0.6–2.0	0.15–0.20	5.6–7.8	High	Low.
			43–78	Moderate	Sandy clay loam or fine sandy loam.	CL	A–6, A–4	---	95–100	90–100	80–95	55–65	35–40	8–22	0.2–0.6	0.15–0.20	7.4–8.4	High	Low.
Wilco: WoB	C	>60	0–14	Low	Loamy fine sand.	SM or SM–SC	A–2–4	---	100	100	80–97	20–30	18–26	2–6	2.0–6.0	0.07–0.10	5.6–6.0	High	Low.
			14–48	Moderate	Sandy clay, sandy clay loam.	SC or CL or CH	A–7–6, A–6	---	95–100	95–100	90–95	45–65	34–55	15–35	0.06–0.2	0.15–0.18	6.1–8.4	High	Low.
			48–96	Moderate	Sandy clay loam, fine sandy loam.	CL, SC	A–7–6 or A–6	---	95–100	95–100	90–95	45–65	30–45	11–30	0.2–0.6	0.10–0.12	7.4–8.4	High	Low.
*Yologo: YOD, YsD. For the Hindes part of YsD, see the Hindes series.	D	7–20	0–4	Low	Gravelly loam, clay loam or sandy clay loam.	GC or SC, or GM–GC, or SM SM–SC	A–6 or A–2–6 or A–2–4 or A–4	0–10	25–95	25–95	20–70	20–49	15–25	5–15	0.6–2.0	0.10–0.15	6.1–7.8	High	Low.
			4–11	Low	Gravelly or very gravelly clay loam or sandy clay loam.	GC or SC	A–6 or A–2–6	5–15	20–70	20–65	20–60	20–49	25–35	11–20	0.6–2.0	0.05–0.10	6.1–7.8	High	Low.
			11–60		Indurated caliche plates and weakly cemented caliche.														

[1] NP means nonplastic.

TABLE 6.—*Interpretations of engineering properties of the soils*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to refer to other series as indicated in the first column of this table. "Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to express degree of limitation or suitability. Absence of an entry means that no interpretation was made]

Soil series and map symbols	Degree and kind of limitations for—						Limitations for—Continued		Suitability as a source of—		Soil features affecting—		
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basement	Sanitary landfill	Roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Grassed waterways
Amphion: AmA, AmB	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: shrink-swell.	Severe: too clayey.	Moderate: shrink-swell; low strength.	Moderate: seepage.	Moderate: compressible.	Fair: shrink-swell; low strength.	Fair: too clayey	Favorable	Favorable	Favorable.
Atco: AtA, AtB	Slight	Moderate: seepage.	Slight	Slight	Slight	Moderate: low strength.	Severe: seepage.	Moderate: compressible; piping; erodes easily.	Fair: low strength.	Poor: excess lime.	Excess lime; droughty.	Favorable	Droughty.
Austin: AuC	Severe: percs slowly.	Severe: depth to rock.	Moderate: depth to rock; too clayey.	Severe: shrink-swell.	Severe: too clayey; depth to rock.	Severe: shrink-swell.	Severe: depth to rock; seepage.	Moderate: unstable fill; thin layer.	Poor: shrink-swell.	Poor: too clayey	Slope; erodes easily; excess lime; droughty.	Slope; erodes easily.	Slope; erodes easily; droughty.
Brackett: BKD	Moderate: percs slowly.	Moderate: slope.	Moderate: depth to rock.	Slight	Severe: depth to rock.	Moderate: low strength.	Severe: depth to rock; seepage.	Severe: thin layer; erodes easily.	Fair: thin layer; low strength.	Poor: thin layer; excess lime.	Slope; erodes easily; excess lime; droughty; rooting depth.	Slope; erodes easily.	Slope; erodes easily; droughty; rooting depth.
BRF. Properties of the Rock outcrop part are too variable for interpretations to be made.	Severe: percs slowly; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: depth to rock.	Severe: slope	Severe: depth to rock; seepage.	Severe: thin layer; erodes easily.	Fair: thin layer; low strength.	Poor: thin layer; excess lime.	Slope; erodes easily; excess lime; droughty; rooting depth.	Slope; erodes easily.	Slope; erodes easily; droughty; rooting depth.
Caid: CdA, CdB, CdC	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Slight	Moderate: low strength.	Moderate: seepage.	Moderate: compressible; piping.	Fair: low strength.	Fair: too clayey.	Favorable	Favorable	Droughty.
Castroville: CsA, CsB	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: too clayey.	Severe: low strength.	Severe: seepage.	Moderate: compressible; piping; erodes easily.	Poor: low strength.	Fair: too clayey; excess lime.	Favorable	Favorable	Favorable.
Devine: DED. Mapped only with Quihi series.	Moderate: percs slowly.	Severe: small stones.	Moderate: small stones.	Slight	Severe: small stones.	Slight	Moderate: seepage.	Moderate: seepage.	Good	Poor: small stones.	Fast intake; droughty; slopes.	Piping	Droughty; slopes.
Dina: DNC	Severe: percs slowly; depth to rock.	Severe: depth to rock.	Severe: depth to rock; small stones.	Moderate: depth to rock.	Severe: depth to rock; small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: thin layer.	Fair: thin layer.	Poor: small stones.	Rooting depth	Rooting depth	Rooting depth; droughty.

TABLE 6.—*Interpretations of engineering properties of the soils*—Continued

Soil series and map symbols	Degree and kind of limitations for—						Limitations for—Continued		Suitability as a source of—		Soil features affecting—		
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basement	Sanitary landfill	Roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Grassed waterways
Divot: Do, Dp	Severe: floods; percs slowly.	Severe: floods.	Severe: floods.	Severe: floods; shrink-swell.	Severe: floods.	Severe: floods; shrink-swell.	Severe: seepage.	Moderate: compressible; piping; erodes easily.	Poor: shrink-swell; low strength	Fair: too clayey; excess lime.	Floods	Not needed	Not needed.
Doss: DSC	Severe: percs slowly; depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock; shrink-swell.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer; low strength.	Poor: thin layer.	Poor: too clayey; excess lime.	Rooting depth; droughty; slope; excess lime.	Depth to rock; slope.	Rooting depth; droughty; slope.
Duval:													
DuA, DuB	Moderate: depth to rock.	Moderate: depth to rock; seepage.	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: low strength.	Moderate: seepage.	Slight	Fair: low strength.	Good	Favorable	Favorable	Favorable.
DwC	Moderate: depth to rock.	Severe: depth to rock; seepage.	Severe: too sandy; depth to rock.	Slight	Moderate: too sandy; depth to rock.	Moderate: low strength.	Severe: seepage.	Moderate: piping; erodes easily.	Fair: low strength.	Poor: too sandy	Fast intake; erodes easily; droughty.	Erodes easily; too sandy.	Erodes easily; droughty.
Eufaula Mapped only in an association with Patilo soils.	Slight	Severe: seepage.	Severe: too sandy.	Slight	Severe: too sandy; seepage.	Slight	Severe: seepage.	Severe: unstable fill; piping; erodes easily; seepage.	Good	Poor: too sandy	Fast intake; droughty.	Too sandy	Droughty.
Hanis: HaA, HaB	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: seepage.	Moderate: compressible; piping.	Fair: shrink-swell.	Fair: too clayey	Favorable	Favorable	Favorable.
Hindes: HNC	Severe: percs slowly.	Moderate: slope; small stones.	Severe: small stones.	Moderate: shrink-swell.	Severe: small stones.	Slight	Severe: seepage.	Moderate: thin layer; piping.	Fair: shrink-swell.	Poor: small stones.	Rooting depth; droughty.	Rooting depth	Rooting depth; droughty; slope.
*Kavett: KAD For the Tarrant part, see the Tarrant series.	Severe: percs slowly; depth to rock.	Severe: depth to rock.	Severe: depth to rock; too clayey.	Severe: shrink-swell; depth to rock.	Severe: depth to rock; too clayey.	Severe: shrink-swell; depth to rock; low strength.	Severe: depth to rock.	Severe: thin layer.	Poor: shrink-swell; low strength.	Poor: too clayey.	Rooting depth; slope; droughty.	Rooting depth; slope.	Rooting depth; slope; droughty.
Kincheloe: KcF	Severe: percs slowly; slope.	Severe: slope	Severe: too clayey; slope.	Severe: shrink-swell; slope.	Severe: too clayey; slope.	Severe: shrink-swell; slope.	Slight	Moderate: compressible; shrink-swell.	Poor: shrink-swell.	Poor: too clayey; slope.	Slow intake; slope; erodes easily.	Slope; erodes easily.	Slope; erodes easily.
Knippa: KnA, KnB	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell; low strength.	Moderate: seepage.	Moderate: compressible; unstable fill.	Poor: shrink-swell; low strength.	Poor: too clayey.	Favorable	Favorable	Favorable.
Lacoste: LaC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock; low strength.	Severe: depth to rock; seepage.	Severe: thin layer.	Good	Fair: too sandy; thin layer.	Rooting depth; slope; droughty; erodes easily.	Depth to rock; slope; erodes easily.	Rooting depth; droughty; erodes easily.
Mercedes: McA, McB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell; low strength.	Slight	Moderate: compressible; unstable fill; shrink-swell.	Poor: shrink-swell; low strength.	Poor: too clayey.	Slow intake	Percs slowly	Percs slowly.
Mereta: MeB	Severe: percs slowly; depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: shrink-swell; depth to rock.	Severe: depth to rock.	Moderate: low strength; shrink-swell.	Severe: depth to rock; seepage.	Severe: thin layer.	Poor: thin layer.	Fair: thin layer; excess lime.	Rooting depth; slopes; excess lime; erodes easily.	Depth to rock; erodes easily.	Rooting depth; slope; erodes easily.
Miguel: MgA, MgB, MhA	Severe: percs slowly.	Slight	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Slight	Moderate: piping; shrink-swell.	Fair: shrink-swell.	Fair: thin layer	Slow intake	Favorable	Favorable.
Monteola:													
MnC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.	Slight	Moderate: shrink-swell.	Poor: shrink-swell.	Poor: too clayey.	Slow intake	Percs slowly	Percs slowly.
MoC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey; small stones.	Severe: shrink-swell.	Severe: too clayey; small stones.	Severe: small stones; shrink-swell.	Slight	Severe: compressible; shrink-swell.	Poor: shrink-swell.	Poor: too clayey; small stones.	Slow intake	Percs slowly	Percs slowly.
Nueces: NuC	Moderate: percs slowly.	Slight	Slight	Slight	Slight	Slight	Moderate: seepage.	Moderate: piping; unstable fill.	Good	Fair: too sandy	Fast intake; droughty.	Too sandy	Erodes easily; droughty.
Olmos: OmD, OND	Severe: depth to rock.	Severe: depth to rock; small stones.	Severe: small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: thin layer.	Good	Poor: too clayey; small stones.	Rooting depth; droughty; slope.	Rooting depth; slope.	Rooting depth; droughty; slope.
Orif: Or	Severe: floods.	Severe: floods; small stones; seepage.	Severe: floods; cutbanks cave.	Severe: floods.	Severe: floods; seepage; cutbanks cave.	Severe: floods.	Severe: seepage.	Moderate: piping.	Good	Poor: small stones; excess lime.	Fast intake; droughty.	Not needed	Not needed.
*Patilo: PEC For the Eufaula part, see the Eufaula series.	Severe: percs slowly.	Severe: seepage.	Severe: cutbanks cave.	Slight	Severe: too sandy; cutbanks cave.	Slight	Severe: seepage.	Moderate: piping; erodes easily.	Good	Poor: too sandy	Fast intake; droughty.	Too sandy	Erodes easily; droughty.
Poth: PoB	Severe: percs slowly.	Slight	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: seepage.	Moderate: piping.	Fair: shrink-swell.	Poor: too sandy	Fast intake; droughty.	Too sandy	Erodes easily; droughty.
Pratley: PrB	Severe: percs slowly; depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: depth to rock.	Severe: low strength; shrink-swell.	Severe: depth to rock.	Severe: shrink-swell; thin layer.	Poor: shrink-swell; low strength.	Poor: too clayey.	Rooting depth	Depth to rock	Rooting depth.

TABLE 6.—*Interpretations of engineering properties of the soils*—Continued

Soil series and map symbols	Degree and kind of limitations for—						Limitations for—Continued		Suitability as a source of—		Soil features affecting—		
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basement	Sanitary landfill	Roads and streets	Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Topsoil	Irrigation	Terraces and diversions	Grassed waterways
*Quihi: QUC, QvD—For the Devine part of QvD, see the Devine series.	Severe: peres slowly; depth to rock.	Severe: depth to rock.	Moderate: depth to rock; small stones.	Moderate: depth to rock.	Severe: depth to rock; small stones.	Moderate: low strength.	Severe: depth to rock.	Moderate: thin layer.	Fair: low strength.	Poor: small stones; too clayey.	Rooting depth droughty; slope.	Depth to rock; slope.	Rooting depth; droughty; slope.
*Real: RED, RkD—For the Brackett part of RkD, see BKD in the Brackett series.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: thin layer.	Good	Poor: small stones.	Rooting depth; slope.	Depth to rock; slope.	Rooting depth.
Rehm: RmD	Moderate: perc slowly; depth to rock.	Moderate: slope; seepage.	Severe: small stones.	Slight	Severe: small stones.	Slight	Moderate: seepage.	Moderate: thin layer.	Good	Poor: small stones.	Rooting depth; slope.	Depth to rock; slope.	Rooting depth; slope.
Rock outcrop: Properties are too variable for interpretations to be made.						Severe:							
Sabenyo: SaC	Moderate: perc slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Moderate: too clayey.	Severe: low strength.	Moderate: seepage.	Slight	Severe: low strength.	Fair: too clayey	Favorable	Favorable	Favorable.
Speck: SPD	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.	Poor: depth to rock.	Poor: thin layer.	Rooting depth; slope.	Depth to rock; slope.	Rooting depth; slope.
*Tarrant: TAD, TAF, TBG, TeD—For the Brackett part of TBG, see BRF in the Brackett series. For the Speck part of TeD, see the Speck series. Properties of the Rock outcrop parts of TAD, TAF, and TBG are too variable for interpretations to be made.	Severe: depth to rock.	Severe: depth to rock; large stones.	Severe: depth to rock.	Severe: depth to rock; shrink-swell.	Severe: depth to rock.	Severe: low strength; depth to rock; shrink-swell.	Severe: depth to rock.	Severe: thin layer; large stones; shrink-swell.	Poor: low strength; thin layer; shrink-swell.	Poor too clayey; thin layer; large stones.	Rooting depth; slope.	Depth to rock; slope; large stones.	Rooting depth; slope; large stones.
Tiocano: To	Severe: floods; perc slowly.	Severe: floods.	Severe: floods; too clayey.	Severe: floods; shrink-swell.	Severe: floods; too clayey.	Severe: low strength; shrink-swell.	Slight	Severe: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Slow intake; floods.	Not needed	Not needed.
Topia: TpB	Severe: perc slowly; depth to rock.	Severe: depth to rock.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: depth to rock.	Severe: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Rooting depth; slow intake.	Rooting depth	Rooting depth.
Valco: VaB	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: low strength; depth to rock.	Severe: depth to rock.	Severe: thin layer.	Fair: low strength.	Fair: thin layer; too clayey.	Rooting depth; droughty.	Depth to rock	Rooting depth; droughty.
Victoria: VcA	Severe: perc slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.	Slight	Severe: shrink-swell.	Poor: low strength; shrink-swell.	Poor: too clayey.	Slow intake	Favorable	Favorable.
Webb: WbA, WbB, WbC	Moderate: perc slowly.	Slight	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell; low strength.	Moderate: seepage.	Moderate: compressible.	Fair; low strength; shrink-swell.	Good	Favorable	Favorable	Favorable.
Wilco: WoB	Moderate: perc slowly.	Slight	Moderate: too sandy.	Moderate: shrink-swell; low strength.	Moderate: too sandy.	Severe: low strength.	Slight	Moderate: piping.	Poor: low strength.	Poor: too sandy	Droughty	Too sandy	Droughty.
*Yologo: YOD, YsD—For the Hindes part of YsD, see the Hindes series.	Severe: depth to rock.	Severe: depth to rock.	Severe: small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: thin layer.	Good	Poor: thin layer; small stones.	Rooting depth; slope.	Depth to rock; slope.	Rooting depth; slope.

TABLE 7.—*Engineering test data*

[Tests performed by the Texas Highway Department, Materials and Testing Division, Camp Hubbard at Austin, except as noted]

Soil name and location	Parent material	Report number	Depth	Shrinkage			Mechanical analysis [1]				Mechanical analysis [1]—Continued								Liquid limit	Plasticity index	Classification [2]	
							Percentage passing sieve—				Percentage passing sieve—Continued					Percentage smaller than—					AASHTO [3]	Unified [4]
				Limit	Lineal	Ratio	1¾ in	1¼ in	⅞ in	⅜ in	⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm				
			In	*Pct*	*Pct*	*Pct*													*Pct*			
Amphion clay loam:																						
13.8 miles south on Farm Road 462 from its intersection with U.S. Highway 90 in Hondo; 0.3 mile east on county road and 100 feet north in an abandoned field. (Modal)	Calcareous clayey sediments.	71-204-R	5-10	15	8.5	1.88	---	---	---	---	---	---	---	100	62	53	35	28	31	16	A-6	CL
		71-205-R	17-26	15	11.0	1.90	---	---	---	---	---	---	---	100	65	58	39	33	36	21	A-6	CL
		71-206-R	39-68	12	11.7	2.00	---	---	100	99	99	98	98	94	72	66	46	33	35	20	A-6	CL
Atco loam:																						
0.6 mile south of U.S. Highway 90 in Castroville on county road along the Medina River, and 150 feet east in an idle field. (Modal)	Calcareous alluvium.	71-226-R	0-9	17	5.7	1.82	---	---	---	---	100	99	99	97	62	53	27	20	28	11	A-6	CL
		71-227-R	15-31	19	6.9	1.77	---	---	---	---	---	---	100	99	68	62	35	23	32	14	A-6	CL
		71-228-R	54-78	17	6.6	1.82	---	---	---	---	---	---	100	99	70	62	33	23	30	14	A-6	CL
Caid sandy clay loam:																						
9.2 miles south on a county road from its junction with U.S. highway 90 at the old Hondo Air Base; 0.1 mile west on county road, 1.5 miles south on a pasture road past ranch headquarters, 0.2 mile west on field boundary road, and 400 feet south in a cultivated field. (Modal)	Calcareous alluvium.	71-207-R	6-13	16	7.0	1.79	---	---	100	99	99	99	99	98	49	39	24	20	30	15	A-6	SC
		71-208-R	24-35	19	8.7	1.85	---	---	---	100	98	96	95	93	59	53	37	29	35	20	A-6	CL
		71-209-R	46-84	12	11.5	2.03	---	---	100	99	99	99	99	97	74	68	47	28	34	20	A-6	CL
Castroville clay loam:																						
3.2 miles north on State Highway 173 from its junction with U.S. Highway 90; 1 mile east; 100 feet east of highway in a cultivated field. (Modal)	Calcareous clayey sediments.	71-229-R	6-16	15	14.0	1.91	---	---	---	---	---	---	100	99	86	77	50	37	45	23	A-7	CL
		71-230-R	28-35	15	13.5	1.91	---	---	---	---	---	---	100	98	90	79	56	45	44	23	A-7	CL
		71-231-R	52-84	18	6.9	1.86	---	---	---	100	99	98	97	95	72	64	39	26	30	14	A-6	CL
Dina gravelly clay loam:																						
1.3 miles north on State Highway 173, 1 mile east, 2.9 miles east on Farm Road 2676, 9.3 miles north on paved county road, and 100 feet west in native range. (Modal)	Limestone bedrock.	71-192-R	0-11	18	11.5	1.76	100	77	72	66	64	62	60	58	51	45	23	13	43	21	A-7-6	CL
		71-193-R	11-31	18	20.5	1.82	100	93	61	53	43	32	26	25	24	23	20	18	72	39	A-2-7	GC
Divot silty clay loam:																						
6.3 miles south on Farm Road 462 from its junction with U.S. Highway 90 in Hondo, 1.8 miles east on county road, and 100 feet south in native range in flood plain of Live Oak Creek. (Modal)	Calcareous alluvium.	71-198-R	0-16	15	14.1	1.86	---	---	---	---	---	---	---	100	91	85	56	41	46	23	A-7-6	CL
		71-199-R	34-65	15	13.5	1.90	---	---	---	---	---	---	100	99	93	89	67	50	44	24	A-7-6	CL
Duval fine sandy loam:																						
13.9 miles south on Farm Road 462 from its junction with U.S. Highway 90, 3.2 miles west on Farm Road 2200, 0.05 mile southwest on county road, then 0.3 mile southeast on pasture road in range. (Modal)	Weakly consolidated sandstone.	71-210-R	0-10	21	1.0	1.62	---	---	---	---	---	100	99	99	19	13	7	5	22	3	A-2-4	SM
		71-211-R	17-44	17	5.3	1.78	---	---	---	---	---	100	99	99	39	34	27	23	27	14	A-6	SC
Hanis sandy clay loam:																						
14.8 miles south of U.S. Highway 90 in Hondo on Farm Road 462, 2 miles east on Farm Road 2200, then 1 mile south and east on county road; 700 feet south of road in a cultivated field. (Modal)	Calcareous clayey sediments.	71-212-R	0-9	15	4.7	1.85	---	---	---	---	---	---	100	97	42	34	24	19	24	10	A-4	SC
		71-213-R	15-25	17	11.5	1.88	---	---	---	---	100	99	99	96	59	53	43	39	40	21	A-6	CL
		71-214-R	46-72	13	13.0	1.95	---	---	100	98	93	84	76	68	49	44	32	28	40	22	A-6	SC
Miguel fine sandy loam:																						
10.9 miles southeast on Highway 173 from its junction with U.S. Highway 90, 3.1 miles south and 1 mile east on county road; 100 feet south in an idle field. (Modal)	Sandy clay loam.	71-221-R	0-10	17	1.5	1.80	---	---	---	100	99	99	99	94	39	27	12	9	19	5	A-4	SM-SC
		71-222-R	18-35	14	12.5	1.94	---	---	---	100	99	99	98	94	66	58	45	42	40	22	A-6	CL
		71-223-R	59-90	19	8.1	1.76	---	---	100	99	97	96	95	91	48	43	29	23	35	20	A-6	SC

See footnotes at end of table.

TABLE 7.—*Engineering test data*—Continued

Soil name and location	Parent material	Report number	Depth	Shrinkage			Mechanical analysis [1]				Mechanical analysis [1]—Continued								Liquid limit	Plasticity index	Classification [2]	
							Percentage passing sieve—				Percentage passing sieve—Continued					Percentage smaller than—						
				Limit	Lineal	Ratio	1¾ in	1¼ in	⅜ in	⅜ in	⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO [3]	Unified [4]
			In	*Pct*	*Pct*	*Pct*													*Pct*			
Nueces fine sand:																						
4.5 miles west on Farm Road 2200 from its junction with State Highway 173; 200 feet north in improved pasture. (Modal)	Sandy clay loam.	71-218-R	14-30	13	1.0	1.90	---	---	---	---	---	---	100	96	32	25	13	9	14	1	A-2-4	SM
		71-219-R	34-42	14	6.5	1.91	---	---	100	98	94	92	91	87	42	38	27	24	26	15	A-6	SC
		71-220-R	53-84	13	6.5	1.94	---	---	---	---	---	---	100	98	49	45	36	31	25	14	A-6	SC
Quihi gravelly clay loam:																						
13.1 miles east on U.S. Highway 90 from its intersection with State Highway 173 and 1 mile northwest on paved county road; in range 50 feet north of fenceline. (Modal)	Indurated caliche.	71-224-R	3-9	15	14.8	1.87	100	88	82	76	71	68	67	65	55	48	29	23	49	24	A-6	CL
		71-225-R	18-26	15	23.8	1.88	63 [5]	47	34	26	21	16	14	13	12	12	10	9	83	48	A-2-7	GC-GP
Victoria clay:																						
8.6 miles east on U.S. Highway 90 from its junction with State Highway 173; 3.3 miles north on county road and 125 feet west in a cultivated field. (Modal)	Calcareous clayey sediments.	71-194-R	16-40	13	19.7	1.95	---	100	99	99	99	99	98	98	89	82	52	45	61	39	A-7-6	CH
		71-195-R	60-70	13	22.7	2.05	---	---	---	100	99	98	97	94	90	86	55	47	70	49	A-7-6	CH
Webb fine sandy loam:																						
11.9 miles south on Farm Road 462 from its junction with U.S. Highway 90; 1.3 miles east of county road and 200 feet north of cattle guard and 100 feet west of private road in range. (Modal)	Weakly consolidated sandstone.	71-201-R	0-12	16	1.5	1.80	---	---	---	---	---	---	100	99	34	26	13	9	18	2	A-2-4	SM
		71-202-R	29-43	15	11.4	1.91	---	---	---	---	---	100	98	96	57	51	42	39	38	22	A-6	CL
		71-203-R	58-78	14	11.5	2.00	---	---	---	---	100	98	95	91	59	55	39	31	36	22	A-6	CL
Wilco loamy fine sand:																						
2.4 miles east on Farm Road 2200 from its junction with Farm Road 462, and 300 feet south on field road in a cultivated field. (Modal)	Sandy clay loam.	71-215-R	6-14	17	0.3	1.73	---	---	---	---	---	---	100	96	24	19	10	9	18	2	A-2-4	SM
		71-216-R	30-48	16	9.1	1.86	---	---	100	99	99	98	97	93	45	62	35	34	34	20	A-6	SC
		71-217-R	60-72	14	14.1	1.91	---	---	---	100	99	98	96	92	53	68	40	37	45	28	A-7-6	CL

[1] Mechanical analyses according to American Association of State Highway and Transportation Officials, standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2v., illus. 1961. AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

[2] AASHTO and Unified classification made by SCS personnel.

[3] Based on AASHTO Designation M145-49.

[4] Based on Unified soil classification system.

[5] Eighty six percent passes 2-inch sieve.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Amphion	Fine, mixed, hyperthermic	Pachic Paleustolls	Mollisols.
Atco	Coarse-loamy, carbonatic, hyperthermic	Aridic Ustochrepts	Inceptisols.
Austin	Fine-silty, carbonatic, thermic	Typic Haplustolls	Mollisols.
Brackett	Loamy, carbonatic, thermic, shallow	Typic Ustochrepts	Inceptisols.
Caid	Fine-loamy, mixed, hyperthermic	Aridic Paleustolls	Mollisols.
Castroville	Fine-silty, mixed, hyperthermic	Typic Calciustolls	Mollisols.
Devine	Clayey-skeletal, mixed, hyperthermic	Udic Paleustalfs	Alfisols.
Dina	Clayey-skeletal, mixed, thermic	Pachic Paleustolls	Mollisols.
Divot	Fine, montmorillonitic, hyperthermic	Vertic Haplustolls	Mollisols.
Doss	Loamy, carbonatic, thermic, shallow	Typic Calciustolls	Mollisols.
Duval	Fine-loamy, mixed, hyperthermic	Aridic Haplustalfs	Alfisols.
Eufaula	Sandy, siliceous, thermic	Psammentic Paleustalfs	Alfisols.
Hanis	Fine, mixed, hyperthermic	Pachic Paleustolls	Mollisols.
Hindes	Clayey-skeletal, mixed, hyperthermic	Aridic Argiustolls	Mollisols.
Kavett	Clayey, montmorillonitic, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Kincheloe	Fine, montmorillonitic, hyperthermic	Typic Ustochrepts	Inceptisols.
Knippa	Fine, mixed, thermic	Vertic Calciustolls	Mollisols.
Lacoste	Loamy, mixed, hyperthermic, shallow	Petrocalcic Paleustalfs	Alfisols.
Mercedes	Fine, montmorillonitic, hyperthermic	Udorthentic Pellusterts	Vertisols.
Mereta	Clayey, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Miguel	Fine, mixed, hyperthermic	Udic Paleustalfs	Alfisols.
Monteola	Fine, montmorillonitic, hyperthermic	Typic Pellusterts	Vertisols.
Nueces	Loamy, mixed, hyperthermic	Aquic Arenic Paleustalfs	Alfisols.
Olmos	Loamy-skeletal, carbonatic, hyperthermic, shallow	Petrocalcic Calciustolls	Mollisols.
Orif	Sandy-skeletal, carbonatic, thermic	Typic Ustifluvents	Entisols.
Patilo	Loamy, siliceous, thermic	Grossarenic Paleustalfs	Alfisols.
Poth	Clayey, mixed, hyperthermic	Arenic Paleustalfs	Alfisols.
Pratley	Fine, montmorillonitic, thermic	Petrocalcic Paleustolls	Mollisols.
Quihi	Clayey-skeletal, mixed, hyperthermic	Petrocalcic Paleustolls	Mollisols.
Real	Loamy-skeletal, carbonatic, thermic, shallow	Typic Calciustolls	Mollisols.
Rehm	Loamy-skeletal, mixed, hyperthermic	Aridic Calciustolls	Mollisols.
Sabenyo	Fine-loamy, carbonatic, hyperthermic	Aridic Ustochrepts	Inceptisols.
Speck	Clayey, mixed, thermic	Lithic Calciustolls	Mollisols.
Tarrant	Clayey-skeletal, montmorillonitic, thermic	Lithic Calciustolls	Mollisols.
Tiocano	Fine, montmorillonitic, hyperthermic	Udic Pellusterts	Vertisols.
Topio	Very-fine, mixed, thermic	Vertic Argiustolls	Mollisols.
Valco	Loamy, mixed, hyperthermic, shallow	Petrocalcic Calciustolls	Mollisols.
Victoria	Fine, montmorillonitic, hyperthermic	Typic Pellusterts	Vertisols.
Webb	Fine, mixed, hyperthermic	Aridic Paleustalfs	Alfisols.
Wilco	Fine, mixed, hyperthermic	Udic Paleustalfs	Alfisols.
Yologo	Loamy-skeletal, mixed, hyperthermic, shallow	Petrocalcic Paleustolls	Mollisols.

TABLE 9.—*Temperature and precipitation*

[All data from Hondo, elevation 901 feet]

Month	Temperature [1]				Precipitation				Precipitation—Continued											
						Probability of receiving—			Probability of receiving—Continued					Mean number of days with— [2]			Snow and sleet			
	Mean daily maximum	Mean monthly highest temperature	Mean daily minimum	Mean monthly lowest temperature	Mean total [1]	0 or trace	0.5 inch or more	1 inch or more	2 inches or more	3 inches or more	4 inches or more	5 inches or more	6 inches or more	0.1 inch or more	0.5 inch or more	1 inch or more	Mean total [1]	Monthly maximum [1]	Greatest depth [2]
	°F	°F	°F	°F	*Inches*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*				*Inches*	*Inches*	*Inches*
January	62.8	81.0	38.6	20.6	1.72	(3)	75	50	28	15	8	4	2	3	1	(4)	0.1	2.5	0
February	66.9	83.4	42.3	26.0	2.22	(3)	80	60	27	15	5	3	1	4	2	1	.2	3.8	1
March	73.9	89.7	47.4	30.3	1.48	2	75	50	25	10	5	3	1	3	1	(4)	(3)	.3	0
April	82.0	93.2	57.4	41.8	2.77	(3)	85	68	45	30	18	10	5	4	2	1	0	0	0
May	87.3	96.5	64.5	51.5	3.67	(3)	98	90	70	48	35	20	15	5	2	1	0	0	0
June	94.1	101.3	70.6	61.8	2.72	(3)	85	74	52	32	22	15	10	3	1	1	0	0	0
July	97.8	103.4	72.1	67.5	1.65	5	75	60	35	20	12	7	5	3	1	1	0	0	0
August	98.4	104.8	71.4	65.5	2.43	4	74	57	38	20	15	9	5	3	2	1	0	0	0
September	91.7	100.3	66.8	54.9	3.89	(3)	85	74	59	40	30	20	16	5	2	2	0	0	0
October	83.1	92.6	57.5	42.0	3.00	5	78	78	45	28	20	15	9	4	2	1	0	1.5	0
November	72.3	86.5	46.5	29.6	1.41	5	70	45	15	5	2	<1	<1	4	1	(4)	.1	2.0	0
December	65.5	81.0	39.9	24.3	1.50	1	70	50	30	18	8	4	2	4	1	(4)	.1	3.8	1
Year	81.3	----	56.3	----	28.46	----	----	----	----	----	----	----	----	45	18	9	.5		

[1] Average length of record is 30 years.
[2] Average length of record is 15 years.
[3] Less than 1 percent.
[4] Less than half a day.
[5] Trace, an amount too small to measure.

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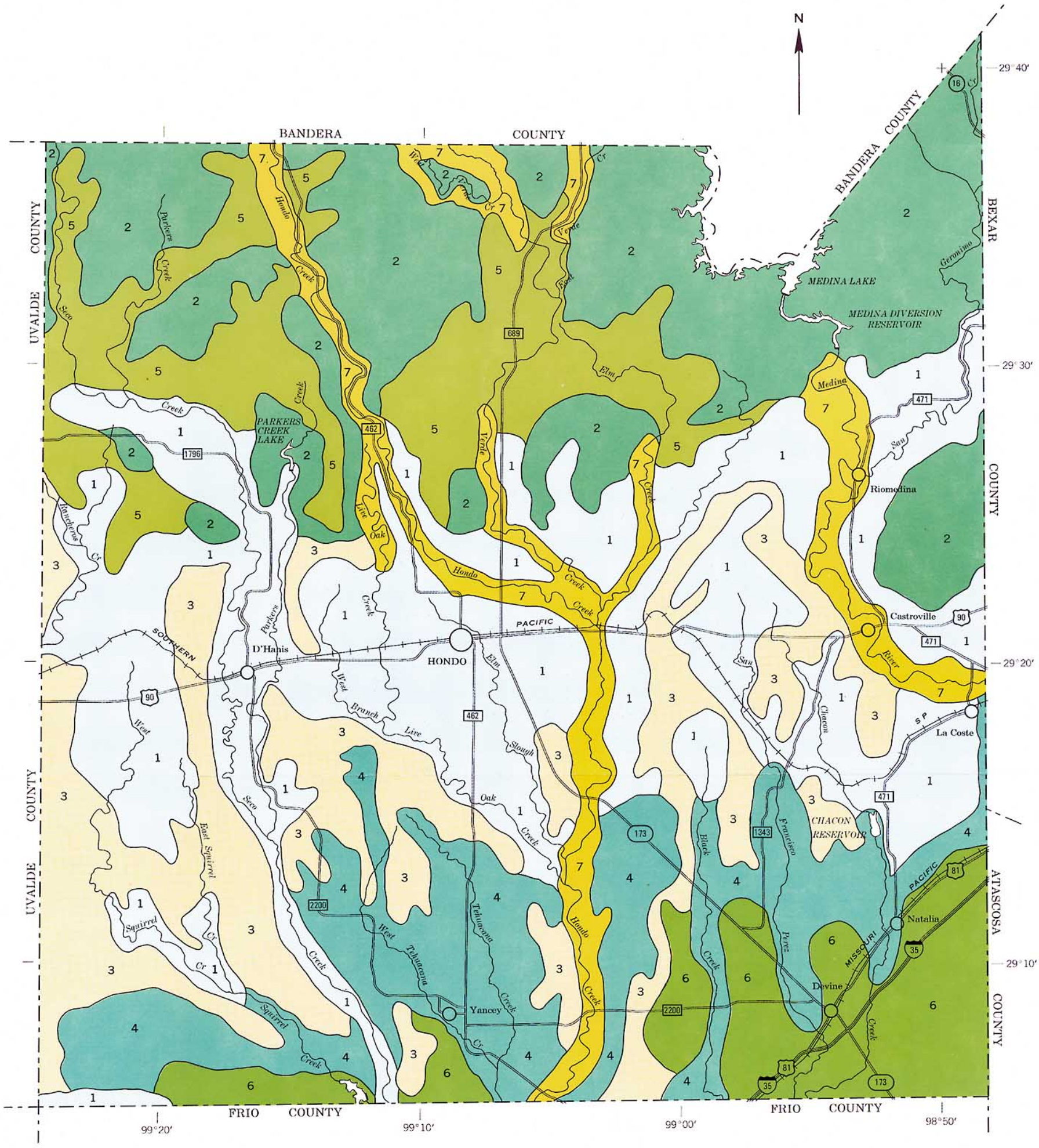


SOIL ASSOCIATIONS *

1. Knippa-Mercedes-Castroville association: Deep, nearly level to gently sloping, loamy and clayey, calcareous soils
2. Tarrant-Real-Brackett association: Very shallow and shallow, gently sloping and undulating to steep, loamy, gravelly loamy, and cobbly clayey, calcareous soils
3. Olmos-Yologo-Hindes association: Very shallow to moderately deep, gently sloping to sloping and undulating, gravelly and loamy, noncalcareous to calcareous soils
4. Duval-Miguel-Amphion association: Deep, nearly level to gently sloping, loamy, noncalcareous soils
5. Speck-Pratley-Mereta association: Moderately deep and shallow, nearly level to gently sloping and undulating, loamy and clayey, noncalcareous to calcareous soils
6. Nueces-Patilo-Eufaula association: Deep, nearly level to gently sloping and gently undulating, sandy, noncalcareous soils
7. Atco-Divot association: Deep, nearly level to gently sloping, loamy, calcareous soils

* The terms for texture used in the descriptive headings of the associations apply to the surface layer of the major soils.

Compiled 1975

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

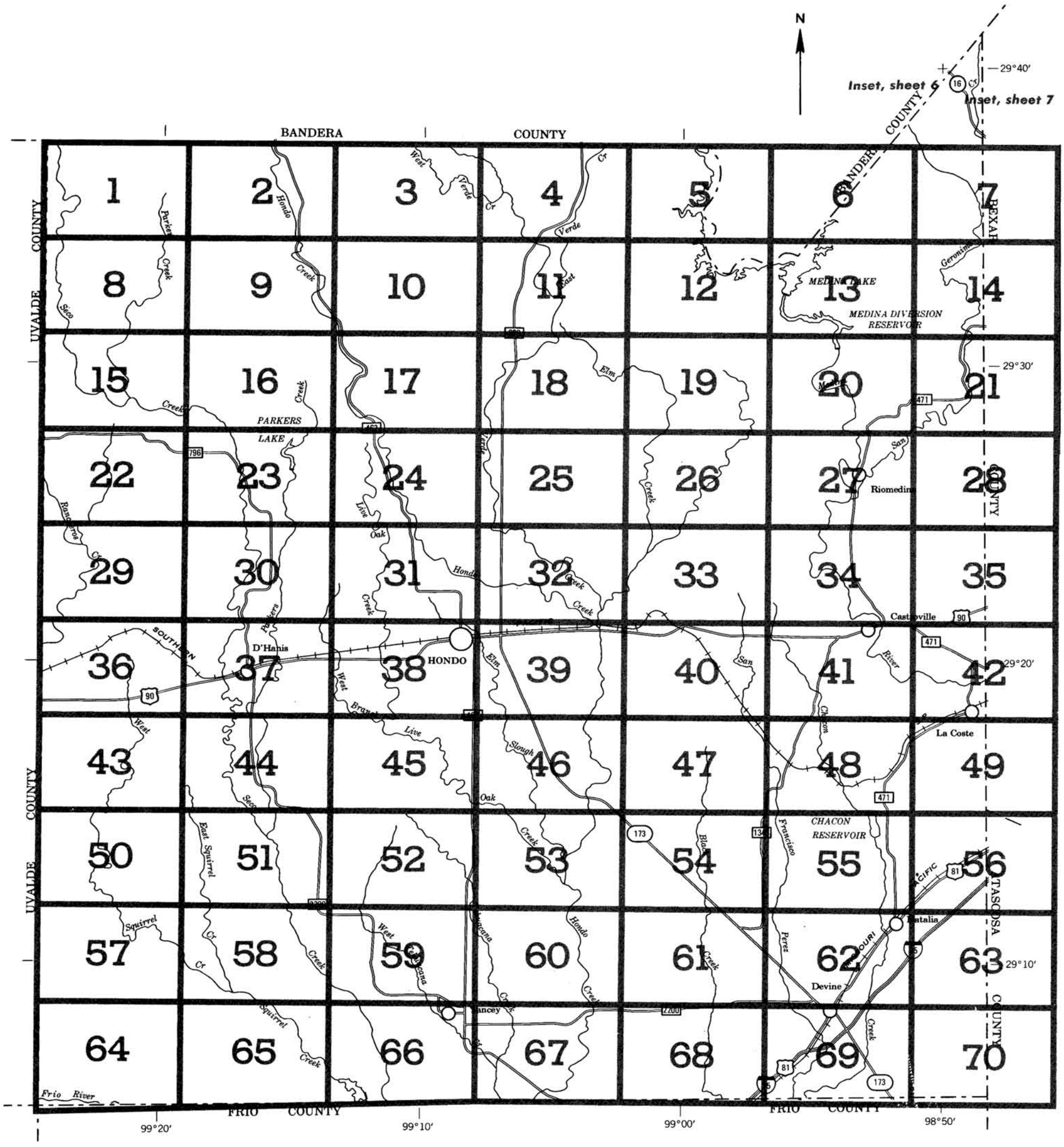
GENERAL SOIL MAP

MEDINA COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

MEDINA COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

Revised November 1975 4-R-31879

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the mapping unit is broadly defined 1/; otherwise, it is a small letter. The third letter, always a capital, shows the slope. Symbols without a slope letter are those of nearly level soils.

SYMBOL	NAME
AmA	Amphion clay loam, 0 to 1 percent slopes
AmB	Amphion clay loam, 1 to 3 percent slopes
AtA	Atco loam, 0 to 1 percent slopes
AtB	Atco loam, 1 to 3 percent slopes
AuC	Austin silty clay, 1 to 5 percent slopes
BKD	Brackett association, undulating
BRF	Brackett-Rock outcrop association, hilly
CdA	Caid sandy clay loam, 0 to 1 percent slopes
CdB	Caid sandy clay loam, 1 to 3 percent slopes
CdC	Caid sandy clay loam, 3 to 5 percent slopes
CsA	Castroville clay loam, 0 to 1 percent slopes
CsB	Castroville clay loam, 1 to 3 percent slopes
DED	Devine association, undulating
DNC	Dina association, gently undulating
Do	Divot clay loam
Dp	Divot clay loam, frequently flooded
DSC	Doss association, gently undulating
DuA	Duval fine sandy loam, 0 to 1 percent slopes
DuB	Duval fine sandy loam, 1 to 3 percent slopes
DwC	Duval loamy fine sand, 0 to 5 percent slopes
HaA	Hanis sandy clay loam, 0 to 1 percent slopes
HaB	Hanis sandy clay loam, 1 to 3 percent slopes
HNC	Hindes association, gently undulating
KAD	Kavett-Tarrant association, undulating
KcF	Kincheloe soils, 10 to 30 percent slopes
KnA	Knippa clay, 0 to 1 percent slopes
KnB	Knippa clay, 1 to 3 percent slopes
LaC	Lacoste soils, 1 to 5 percent slopes
McA	Mercedes clay, 0 to 1 percent slopes
McB	Mercedes clay, 1 to 3 percent slopes
MeB	Mereta clay, 1 to 3 percent slopes
MgA	Miguel fine sandy loam, 0 to 1 percent slopes
MgB	Miguel fine sandy loam, 1 to 3 percent slopes
MhA	Miguel soils, 0 to 1 percent slopes
MnC	Monteola clay, 1 to 5 percent slopes
MoC	Monteola gravelly clay, 1 to 5 percent slopes
NuC	Nueces soils, 0 to 5 percent slopes
OmD	Olmos complex, 1 to 8 percent slopes
OND	Olmos association, undulating
Or	Orif complex
PEC	Patilo-Eufaula association, gently undulating
PoB	Poth loamy fine sand, 0 to 3 percent slopes
PrB	Pratley clay, 0 to 3 percent slopes
QUC	Quihi association, gently undulating
QvD	Quihi and Devine soils, 1 to 8 percent slopes
RED	Real association, undulating
RkD	Real and Brackett soils, 1 to 8 percent slopes
RmD	Rehm complex, 1 to 8 percent slopes
SaC	Sabenyo clay loam, 1 to 5 percent slopes
SPD	Speck association, undulating
TAD	Tarrant-Rock outcrop association, undulating
TAF	Tarrant-Rock outcrop association, hilly
TBG	Tarrant-Rock outcrop-Brackett association, steep
TeD	Tarrant and Speck soils, 1 to 8 percent slopes
To	Tiocano clay
TpB	Topia clay, 0 to 2 percent slopes
VaB	Valco clay loam, 0 to 2 percent slopes
VcA	Victoria clay, 0 to 1 percent slopes
Wba	Webb fine sandy loam, 0 to 1 percent slopes
WbB	Webb fine sandy loam, 1 to 3 percent slopes
WbC	Webb fine sandy loam, 3 to 5 percent slopes
WoB	Wilco loamy fine sand, 0 to 3 percent slopes
YOD	Yologo association, undulating
YsD	Yologo and Hindes soils, 1 to 8 percent slopes

1/ The composition of these units is more variable than that of others in the survey area but has been controlled well enough to be interpreted for the expected use of the soils.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (75)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)

MEDINA COUNTY, TEXAS NO. 1

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 2

MEDINA COUNTY, TEXAS NO. 2

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 3

MEDINA COUNTY, TEXAS NO. 3

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Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 930 000 FEET

650 000 FEET

BANDERA COUNTY

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 10)

635 000 FEET

1 955 000 FEET

3

N

2 Miles

10000 Feet

1 5000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

MEDINA COUNTY, TEXAS — SHEET NUMBER 4

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 4

MEDINA COUNTY, TEXAS — SHEET NUMBER 5

MEDINA COUNTY, TEXAS NO. 5

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 990 000 FEET

650 000 FEET

BANDERA COUNTY

MEDINA LAKE

BANDERA COUNTY

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 12)

635 000 FEET

2 015 000 FEET

5

N

2 Miles

10000 Feet

1 5000

Cypress Creek

Middle Spring

Indian Spring

Cypress Cove

water

KAD BRF PrB BKD TBG MeB TAF SPD RKD TpB AtB Do TAD

MEDINA COUNTY, TEXAS — SHEET NUMBER 6

6

N

2 Miles

10000 Feet

1 5000

0 0 1000

¼ ¼ 2000

½ ½ 3000

¾ ¾ 4000

1 5000

635 000 FEET

2 020 000 FEET

2 045 000 FEET

650 000 FEET

(Joins lower left)

(Joins sheet 7)

(Joins sheet 13)

INSET A

2 049 000 FEET

655 000 FEET

2 044 000 FEET

(Joins upper right)

(Joins inset, sheet V)

INSET B

2 061 000 FEET

675 000 FEET

2 057 000 FEET

670 000 FEET

(Joins inset, sheet 7)

BANDERA COUNTY

BEXAR COUNTY

MEDINA LAKE

Cherry Spring

Pecan Spring

Habys Cove

Dripping Spring Creek

P37

1283

TBG

TAD

BRF

PrB

BKD

TAF

MeB

RkD

RED

SPD

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 6

MEDINA COUNTY, TEXAS NO. 7

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 050 000 FEET

(Joins lower right)

650 000 FEET

(Joins sheet 6)

Indian Mound Springs

Honeymoon Spring

San Geronimo Creek

(Joins sheet 14)

2 060 000 FEET

(Joins inset, sheet 6)

670 000 FEET

BANDERA COUNTY

BEXAR COUNTY

(Joins inset, sheet 6)

655 000 FEET

(Joins upper left)

2 060 000 FEET

7

N

MEDINA COUNTY, TEXAS — SHEET NUMBER 8

8

N

2 Miles

10000 Feet

1 5000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

1 895 000 FEET

630 000 FEET

615 000 FEET

1 870 000 FEET

(Joins sheet 15)

(Joins sheet 9)

UVALDE COUNTY

Seco Creek

Deadman Hollow

Parkers Creek

MeB PrB RED TBG BKD BRF RkD AtB Or Dp CsA VaB AtA Do TeD SPD TAD TAF

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 8

MEDINA COUNTY, TEXAS — SHEET NUMBER 9

MEDINA COUNTY, TEXAS NO. 9

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 900 000 FEET

630 000 FEET

615 000 FEET

1 925 000 FEET

(Joins sheet 8)

(Joins sheet 2)

(Joins sheet 10)

(Joins sheet 16)

9

N

2 Miles

10000 Feet

1 5000

0 0

¼ 1000

½ 2000

¾ 3000

¾ 4000

1 5000

Eagle Bluff

Turkey Hollow

HONDO CREEK

Rocky Creek

Barnes Bluff

462

TBG BRF BKD MeB TeD PrB RED TAD TAF SPD KAD AtB KnA VaB CsA TpB Do DNC OfA

MEDINA COUNTY, TEXAS — SHEET NUMBER 10

10

N

2 Miles

10000 Feet

1 5000 0 1000 2000 3000 4000 5000

1 955 000 FEET

630 000 FEET

615 000 FEET

1 930 000 FEET

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 17)

Martin Creek

Twin Hollow

HONDO CREEK

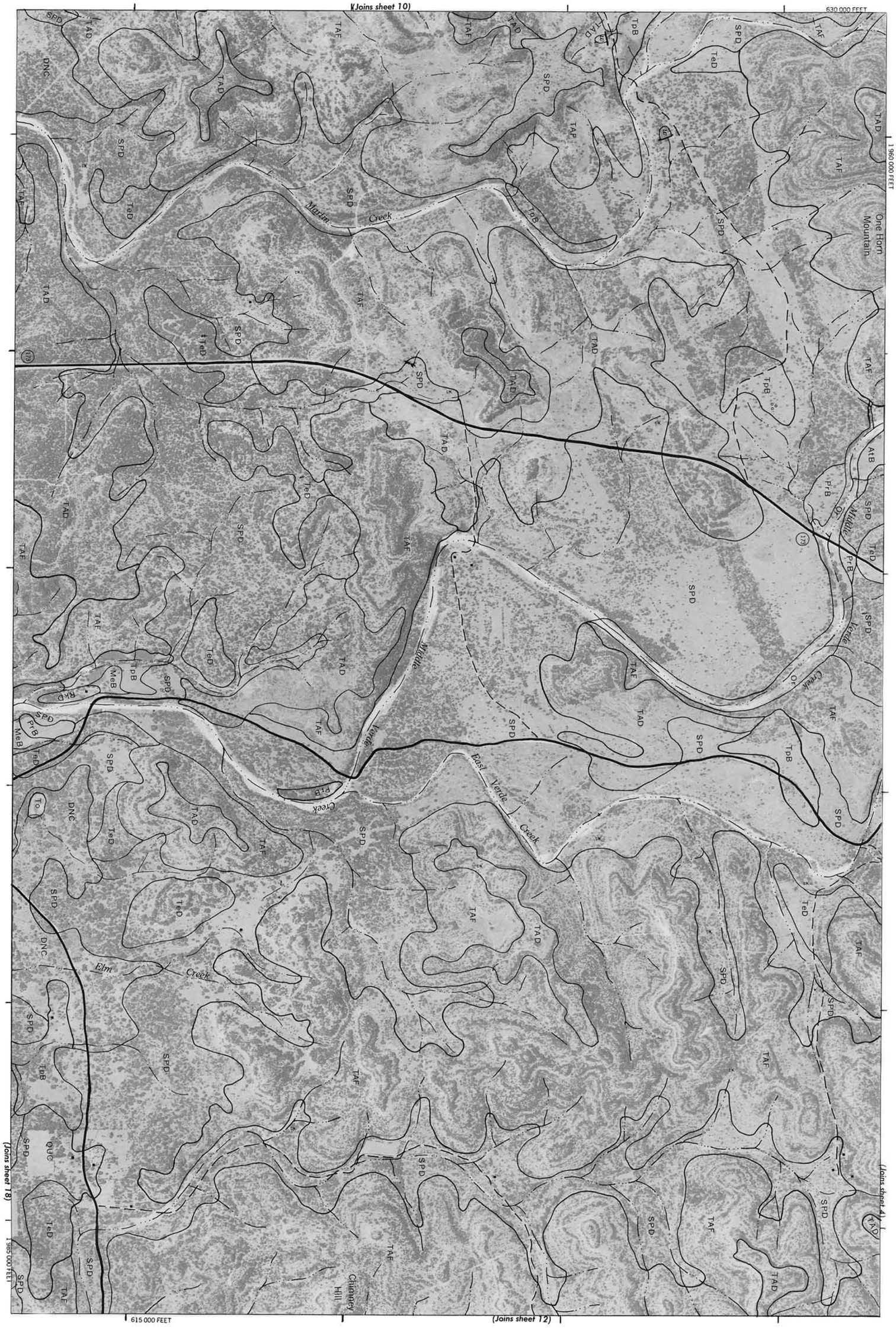
DNC

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 10

MEDINA COUNTY, TEXAS NO. 11

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



MEDINA COUNTY, TEXAS — SHEET NUMBER 11

MEDINA COUNTY, TEXAS — SHEET NUMBER 12

12

N

2 Miles

10000 Feet

1 5000

0 0 1000 2000 3000 4000 5000

(Joins sheet 5)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 19)

2 015 000 FEET

630 000 FEET

615 000 FEET

1 990 000 FEET

BANDERA COUNTY

MEDINA LAKE

Water Canyon

Antone Hollow

Polecat Hollow

Mormon Bluff

Sawmill Cove

Point Comfort

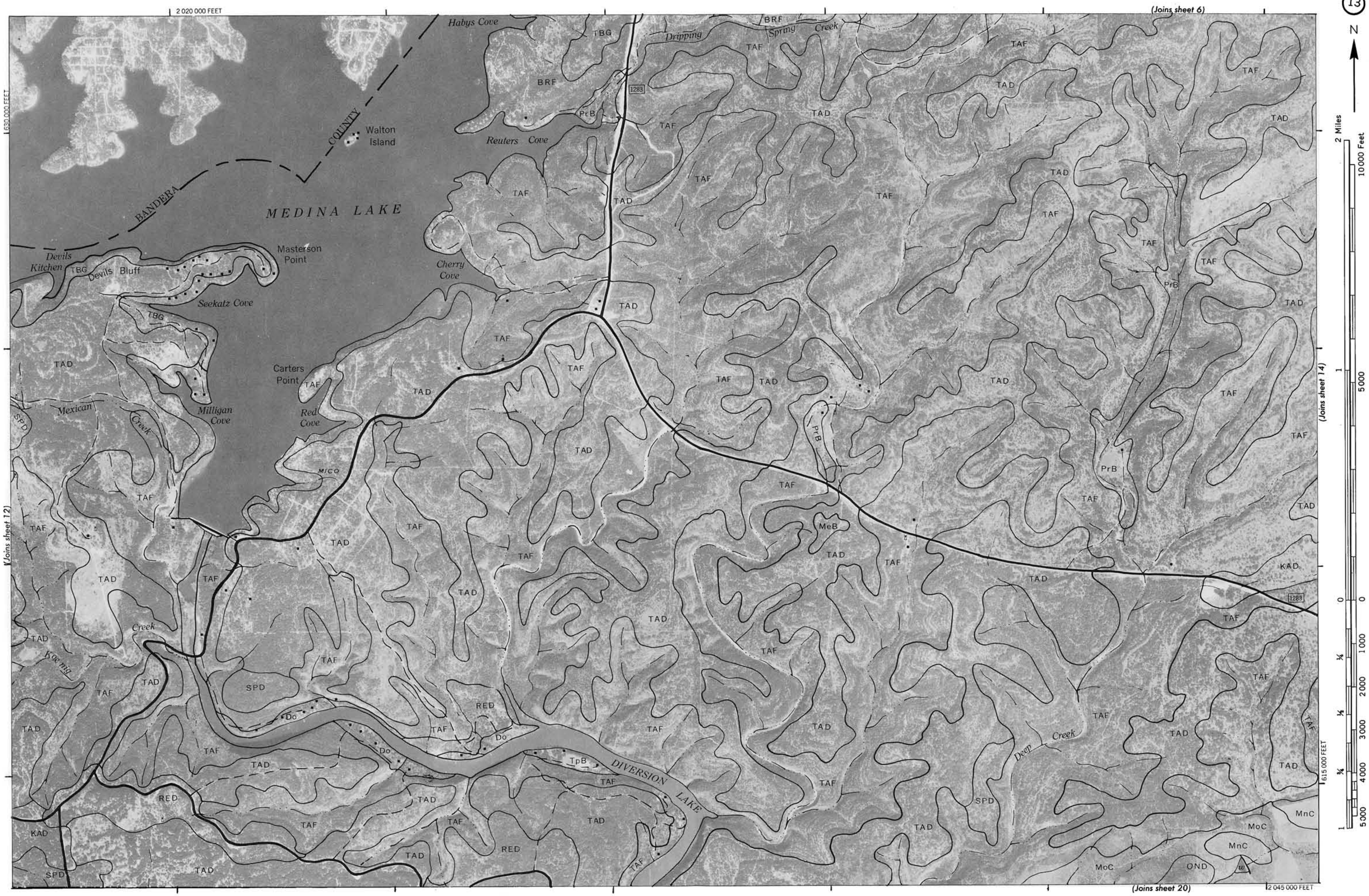
Koenig Creek

Elm Creek

TAF TAD SPD TeD DNC PrB TBG TpB KAD

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 12



MEDINA COUNTY, TEXAS NO. 13

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 14

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

630 000 FEET

2 075 000 FEET

MEDINA COUNTY, TEXAS — SHEET NUMBER 14

14 N

2 Miles 1 0 1 5000 4000 3000 2000 1000 0 5000 10000 Feet

MEDINA COUNTY, TEXAS NO. 15

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 870 000 FEET

610 000 FEET

595 000 FEET

1 895 000 FEET

(Joins sheet 8)

(Joins sheet 16)

(Joins sheet 22)

UVALDE COUNTY

Seco Creek

Cedar Creek

Airfield

1796

MeB PrB RED SPD TAD TAF TeD TpB KAD McA VaB CsA AtA Do KnB SaC KnA AtB Or To VcA McB

N

2 Miles

10000 Feet

1

5000

0

1000

2000

3000

4000

5000

MEDINA COUNTY, TEXAS — SHEET NUMBER 16

16

N

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

(Joins sheet 9)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 23)

1 925 000 FEET

610 000 FEET

595 000 FEET

1 900 000 FEET

TAF TAD TeD SPD KAD McA TpB RED VaB MeB AtB Or SaC AtA KnA KnB VcA To CsA PrB McB MeB

Seco Creek

Rocky Creek

Parkers Creek

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 16

MEDINA COUNTY, TEXAS — SHEET NUMBER 17

MEDINA COUNTY, TEXAS NO. 17

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 18

18

N

2 Miles — 10000 Feet

1 — 5000

1 — 5000 — 4000 — 3000 — 2000 — 1000 — 0 — 0

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 18

MEDINA COUNTY, TEXAS — SHEET NUMBER 19

MEDINA COUNTY, TEXAS NO. 19

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 990 000 FEET

610 000 FEET

(Joins sheet 12)

(Joins sheet 18)

(Joins sheet 20)

(Joins sheet 26)

12 015 000 FEET

595 000 FEET

19

N

2 Miles

10000 Feet

5000

1

0

1000

2000

3000

4000

5000

Creek

Elm

Polecat

Quihi

Creek

Creek

Creek

(20)

MEDINA COUNTY, TEXAS — SHEET NUMBER 20

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 20

MEDINA COUNTY, TEXAS — SHEET NUMBER 21

(21) N

2 Miles 1 0 ¼ ¼ ½ 0 1 5000 4000 3000 2000 1000 0 5000 10000 Feet

595 000 FEET

2075 000 FEET

2 050 000 FEET

610 000 FEET

BEXAR COUNTY

(Joins sheet 14)

(Joins sheet 20)

(Joins sheet 28)

San Geronimo Creek

MEDINA COUNTY, TEXAS NO. 21

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 22

22

N

2 Miles

10000 Feet

1 5000 0 1000 2000 3000 4000 5000

(Joins sheet 15)

1 895 000 FEET

590 000 FEET

575 000 FEET

1 870 000 FEET

(Joins sheet 29)

(Joins sheet 23)

UVALDE COUNTY

Little Comanche Creek

Rancheros Creek

Automotive Test Facility

1796

McB PrB RED KnB MeB VcA KnA McA VaB RkD TAD SaC Or SPD

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 22

MEDINA COUNTY, TEXAS NO. 23

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 ¾ ½ ¼ 0 1 2 Miles

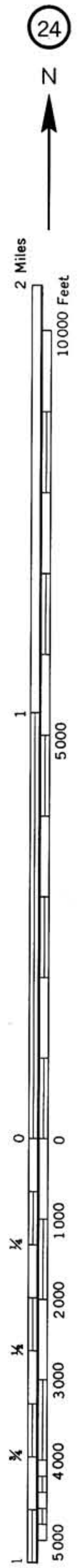
5000 4000 3000 2000 1000 0 5000 10000 Feet

N

MEDINA COUNTY, TEXAS — SHEET NUMBER 23

23

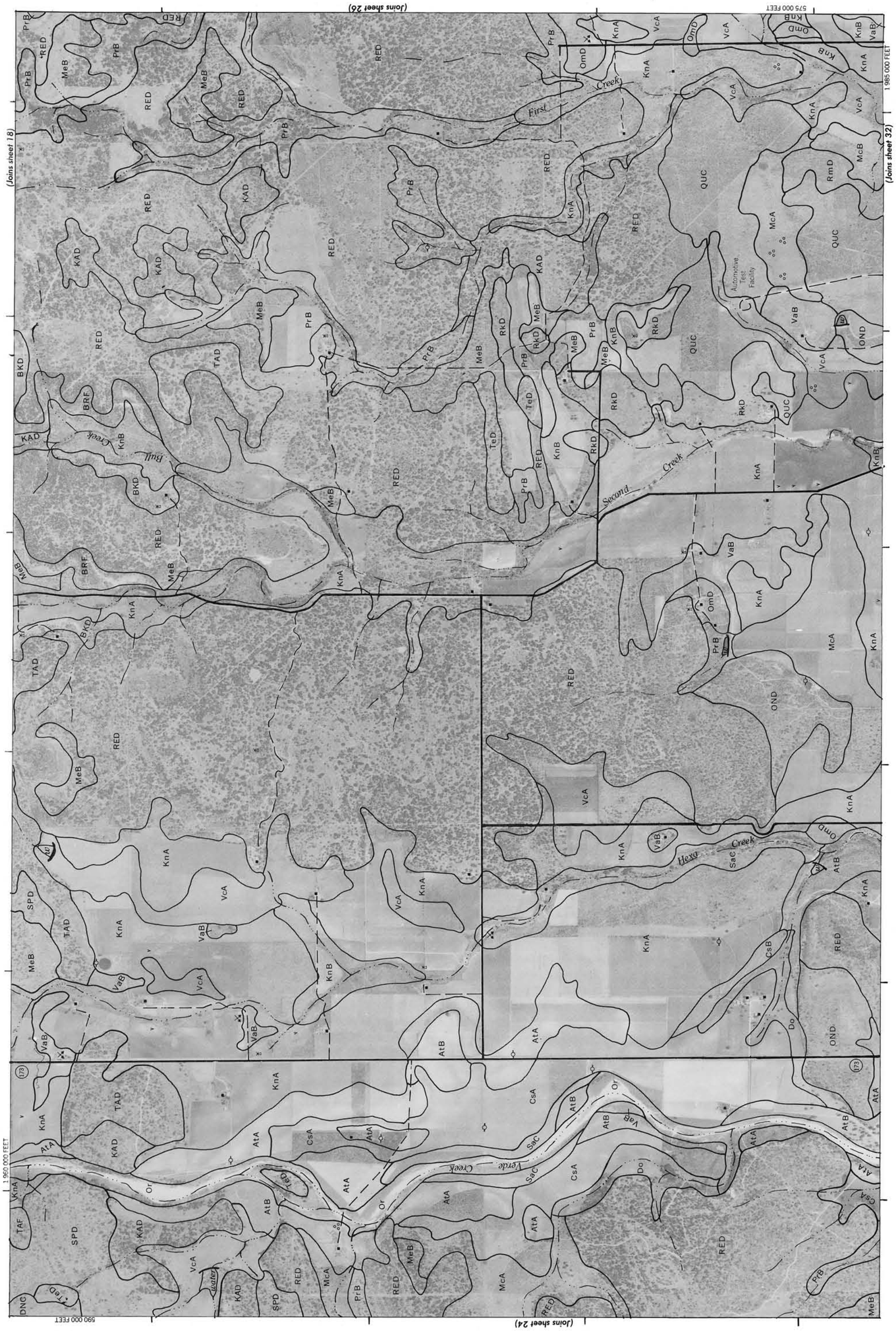
MEDINA COUNTY, TEXAS — SHEET NUMBER 24



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 24

MEDINA COUNTY, TEXAS — SHEET NUMBER 25



MEDINA COUNTY, TEXAS NO. 25

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 26

26

N

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

(Joins sheet 19)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 33)

2 015 000 FEET

590 000 FEET

575 000 FEET

1 990 000 FEET

Polecat Creek

Elm Creek

Quihi Creek

Upper Quihi

Elm Creek

2676

2676

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 26

MEDINA COUNTY, TEXAS — SHEET NUMBER 27

MEDINA COUNTY, TEXAS NO. 27

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 020 000 FEET

590 000 FEET

(Joins sheet 20)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 34)

2 045 000 FEET

575 000 FEET

27

N

2 Miles

10000 Feet

5000

1

0

1000

2000

3000

4000

5000

Medina River

Mesquite Creek

Geronimo Creek

San Geronimo Creek

Water Creek

IRRIGATION CANAL

MEDINA

Riomedina

Indian Hill

2676

471

1957

MEDINA COUNTY, TEXAS — SHEET NUMBER 28

28

N

2 Miles 10000 Feet

1 5000

(Joins sheet 21)

(Joins sheet 27)

(Joins sheet 35)

2 075 000 FEET

590 000 FEET

575 000 FEET

2 050 000 FEET

Do SaC KnA CsA VcA To KnB MeB TAD CsB MnC PrB AuC DSC RED KAD RkD SPD KcF Loma Alta 1957 Airfield

San Geronimo Creek

Potranca Creek

Big Sous Creek

BEXAR COUNTY

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 28

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 30

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 31

MEDINA COUNTY, TEXAS NO. 31

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 32

32

N

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

(Joins sheet 25)

(Joins sheet 31)

(Joins sheet 39)

(Joins sheet 33)

1 985 000 FEET

1960 000 FEET

555 000 FEET

570 000 FEET

Vandenburg Community

HONDO CREEK

Verde Creek

Hext Creek

Second Creek

First Creek

Quihi Creek

Ball Waterhole Creek

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 32

MEDINA COUNTY, TEXAS — SHEET NUMBER 33

MEDINA COUNTY, TEXAS NO. 33

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 990 000 FEET

570 000 FEET

(Joins sheet 26)

(Joins sheet 34)

(Joins sheet 32)

(Joins sheet 40)

2 015 000 FEET

555 000 FEET

33

N

2 Miles

10000 Feet

1 5000

0 1000 2000 3000 4000 5000

Quihi

Quihi Creek

Elm Creek

Cherry Creek

Opossum Creek

Quihi Creek

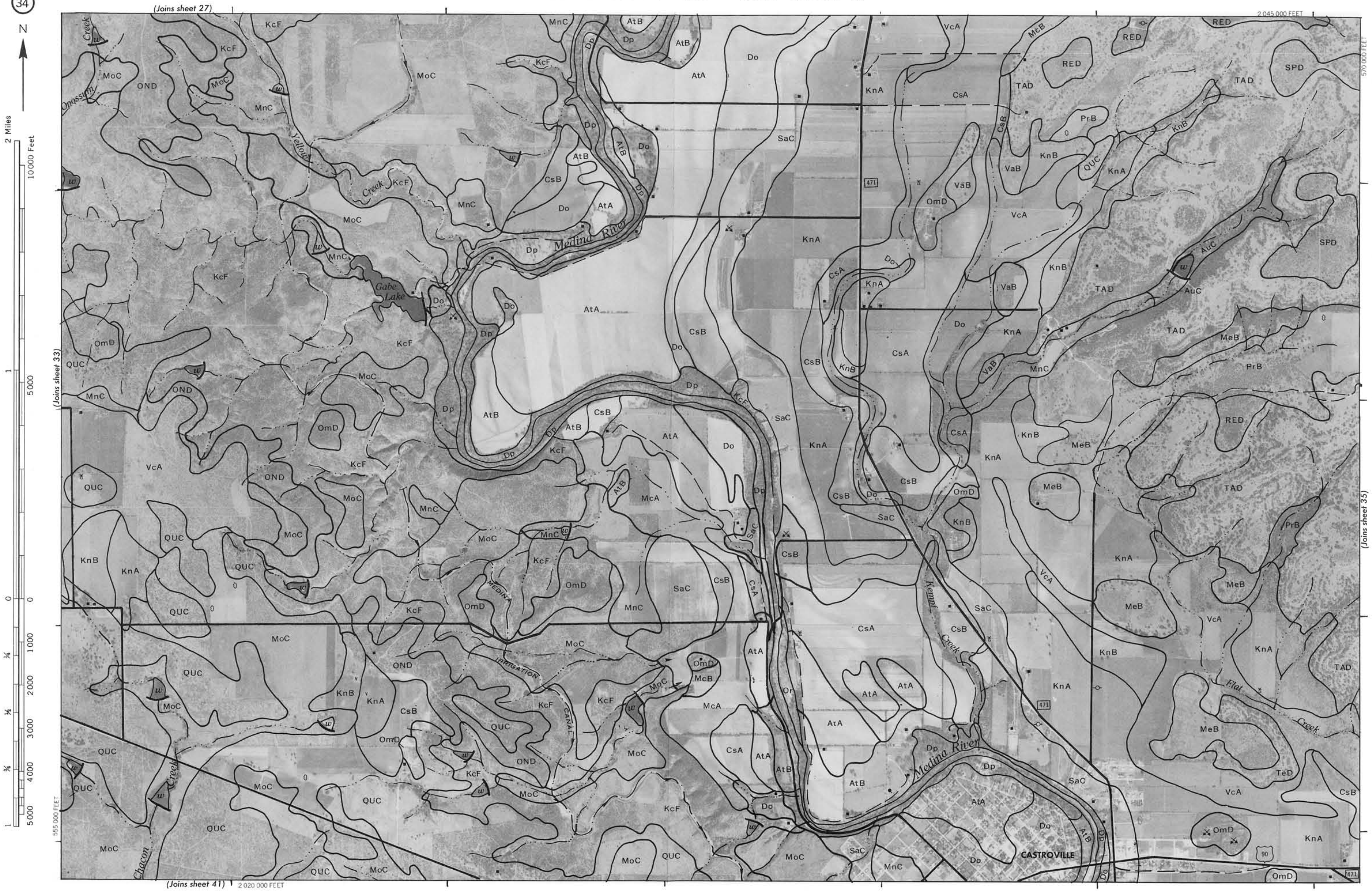
Dry San Francisco Creek

SOUTHERN PACIFIC

water

2676

MEDINA COUNTY, TEXAS — SHEET NUMBER 34



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 35

MEDINA COUNTY, TEXAS NO. 35

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 050 000 FEET

570 000 FEET

(Joins sheet 28)

(Joins sheet 34)

(Joins sheet 42)

555 000 FEET

2 075 000 FEET

BEXAR COUNTY

Big Sous Creek

Little Sous Creek

Dry Branch

Flat Creek

SPD, RED, TAD, DSC, AuC, MeB, PrB, RkD, CsB, KnB, KnA, TeD, McA, MnC, VcA

35

N

2 Miles

10000 Feet

1 5000

¼ 2000

½ 3000

¾ 4000

1 5000

0 0

¼ 1000

36

N

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

(Joins sheet 29)

1 895 000 FEET

550 000 FEET

535 000 FEET

1 870 000 FEET

(Joins sheet 43)

(Joins sheet 37)

UVALDE COUNTY

Ranchotas Creek

PACIFIC SOUTHERN

Tower

Elm Creek

East Squirrel Creek

West Squirrel Creek

water

Airfield

90

KnA KnB McA McB McC OND QUC RmD To VaB VcA YOD YsD CsA CsB Dp Do KcF MnC OmD

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 36

MEDINA COUNTY, TEXAS — SHEET NUMBER 37

MEDINA COUNTY, TEXAS NO. 37

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 900 000 FEET

550 000 FEET

(Joins sheet 30)

(Joins sheet 38)

(Joins sheet 36)

(Joins sheet 44)

1 925 000 FEET

535 000 FEET

37

N

2 Miles

10000 Feet

5000

0 1000 2000 3000 4000 5000

Seco Creek

Parkers Creek

Seco Creek

Parkers Creek

PACIFIC

SOUTHERN

D'Hanis

water

1796

90

90

MEDINA COUNTY, TEXAS — SHEET NUMBER 38

38 N

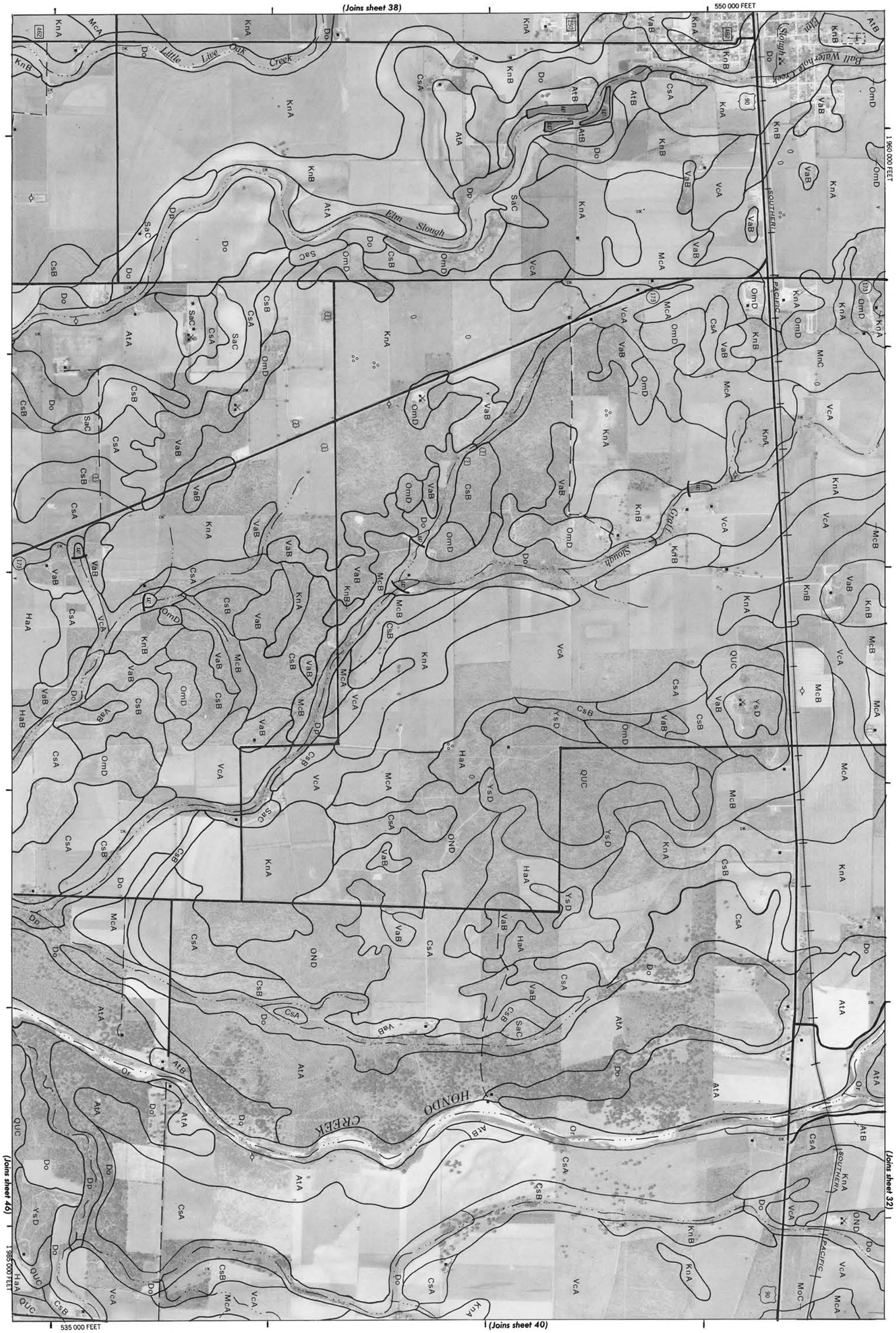
2 Miles 1 0 1 | 10 000 Feet 5 000 0 1 000 2 000 3 000 4 000 5 000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 38

MEDINA COUNTY, TEXAS NO. 39

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



MEDINA COUNTY, TEXAS — SHEET NUMBER 39

MEDINA COUNTY, TEXAS — SHEET NUMBER 40

40

N

2 Miles 10000 Feet

1 5000

¼ 1000

½ 2000

¾ 3000

1 4000

5000

0

(Joins sheet 33)

2 015 000 FEET

550 000 FEET

(Joins sheet 39)

(Joins sheet 41)

535 000 FEET

(Joins sheet 47)

1 990 000 FEET

SOUTHERN PACIFIC

Dunlay

water

Perez Creek

San Francisco

VcA McA OmD VaB MoC AmB MnC RmD OND QUC KnA YsD KnB YOD CsA CsB HaB McB Do To Dp

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 40

MEDINA COUNTY, TEXAS — SHEET NUMBER 41

41

N

2 020 000 FEET

550 000 FEET

535 000 FEET

2 045 000 FEET

(Joins sheet 34)

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 48)

CASTROVILLE

Medina River

Chacon Creek

IRRIGATION CANAL

Rhins Hill

Flea Hill

2 Miles

10000 Feet

5000

MEDINA COUNTY, TEXAS NO. 41

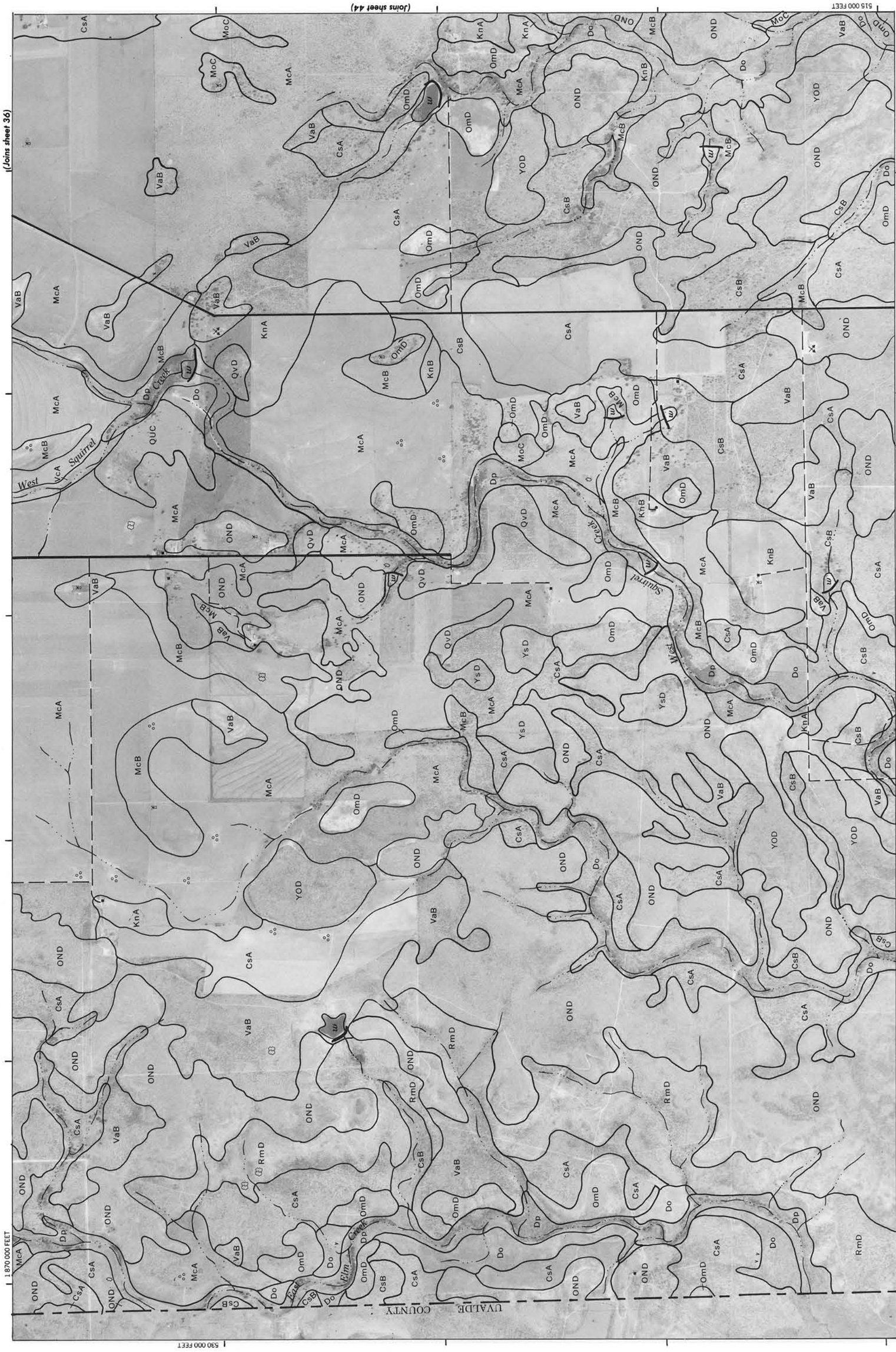
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 42

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 42

MEDINA COUNTY, TEXAS — SHEET NUMBER 43

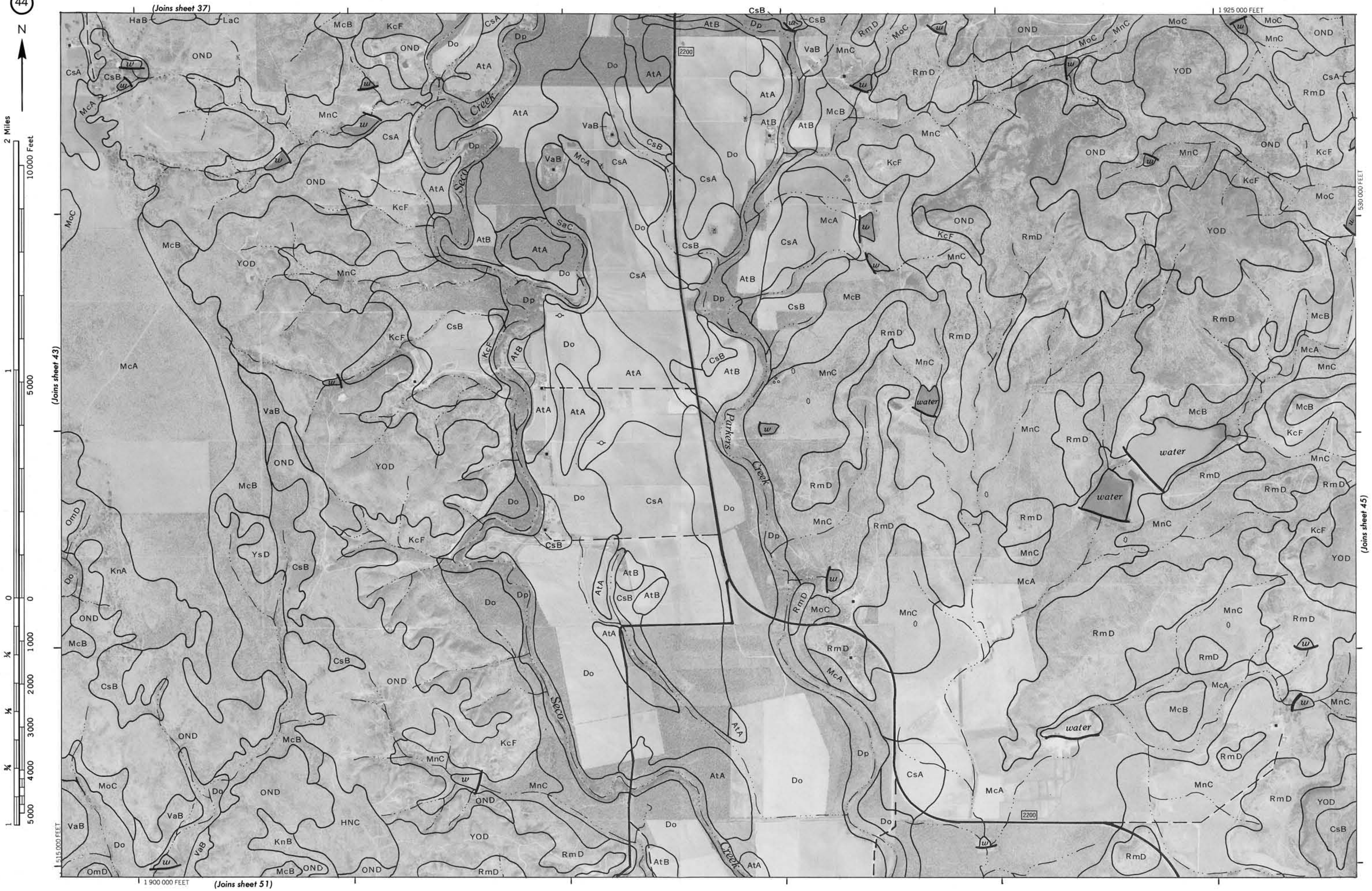


43

MEDINA COUNTY, TEXAS NO. 43

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 44

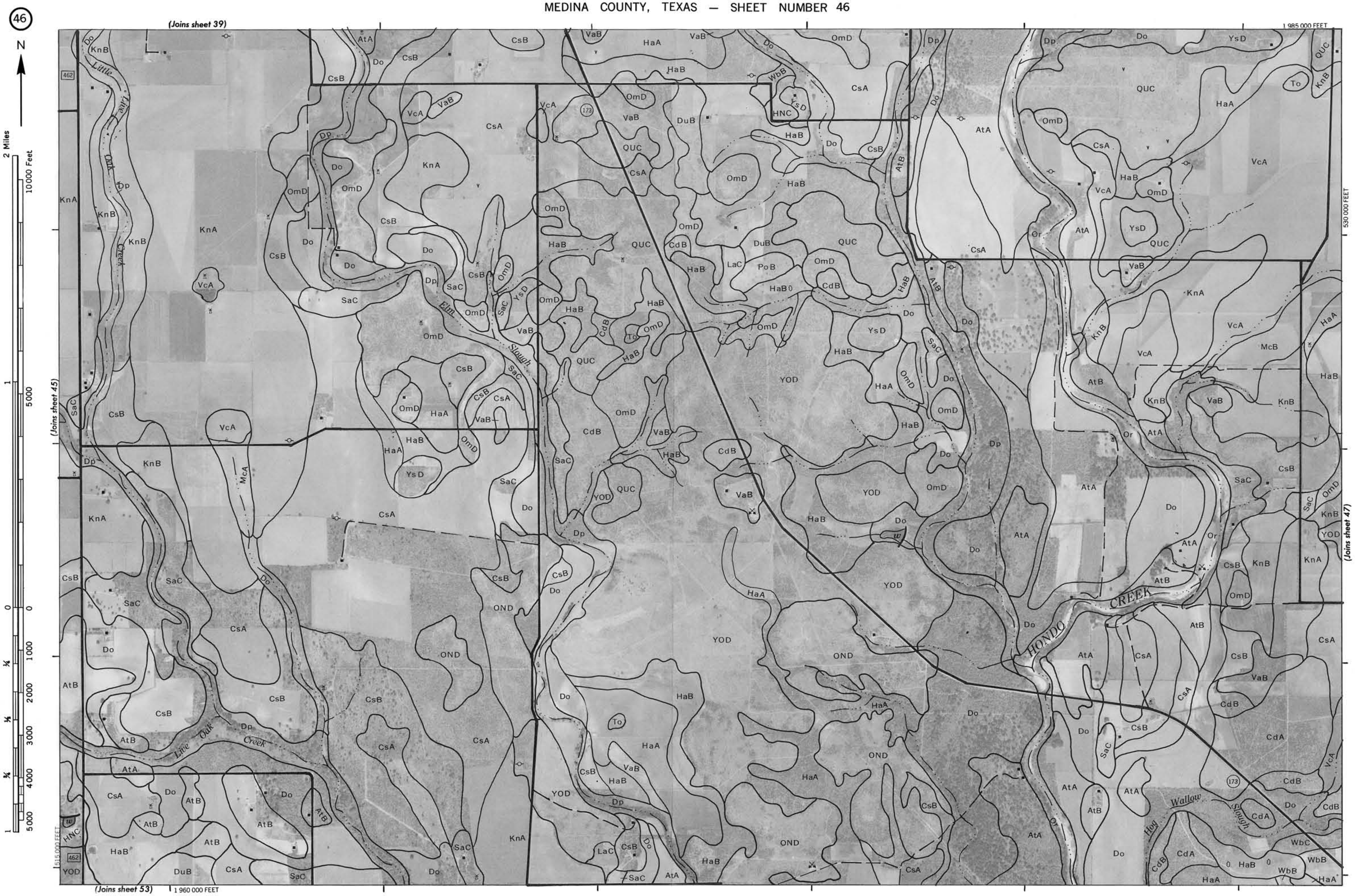


This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 45

MEDINA COUNTY, TEXAS NO. 45

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 47

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 48

48

N

2 Miles 10000 Feet

1 5000 0 0 1000 ¼ 2000 ¼ 3000 ¼ 4000 ½ 5000 1

(Joins sheet 41)

2 045 000 FEET

530 000 FEET

(Joins sheet 47)

(Joins sheet 49)

(Joins sheet 55)

2 020 000 FEET

515 000 FEET

Chacon Creek

Goose Creek

Sun Francisco Perez Creek

MEDINA IRRIGATION CANAL

NATALIA CANAL

SOUTHERN PACIFIC

Ruby Lake

water

Pearson

1343

471

MnC MoC OMD OND RmD VcA McA McB CsB CsA VaB AmB AmA DuB HaA HaB HNC KcF KnB LaC QUC QvD SaC YOD YsD CdB CdC Do Dp

This map is compiled on 1973 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 48

TEXAS — SHEET NUMBER 49

MEDINA COUNTY, TEXAS NO. 49

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 50

50

N

2 Miles

10000 Feet

1 5000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 43)

1 895 000 FEET

515 000 FEET

500 000 FEET

1 870 000 FEET

(Joins sheet 57)

(Joins sheet 51)

UVALDE COUNTY

Do, OND, YOD, VaB, CsB, Dp, CsA, OmD, McB, RmD, YsD, McA, To, HNC, MnC, OmD, SaC, HaA, HaB, water, w

West Squirrel Creek

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 50

MEDINA COUNTY, TEXAS — SHEET NUMBER 51

MEDINA COUNTY, TEXAS NO. 51

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 900 000 FEET

515 000 FEET

(Joins sheet 44)

(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 58)

1 925 000 FEET

500 000 FEET

51

N

2 Miles

10000 Feet

1 5000

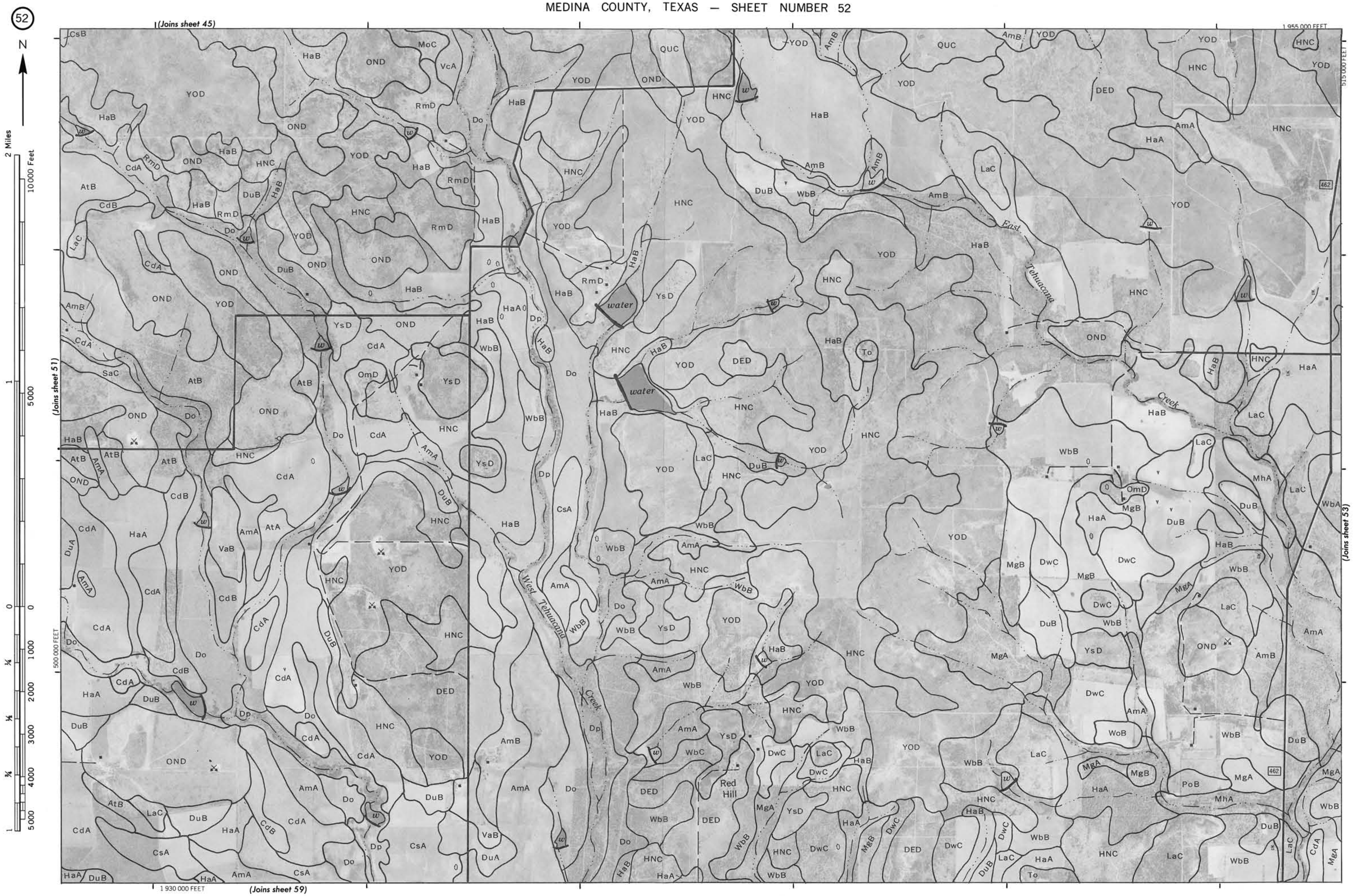
¼ 1000

½ 2000

¾ 3000

0 4000

0 5000

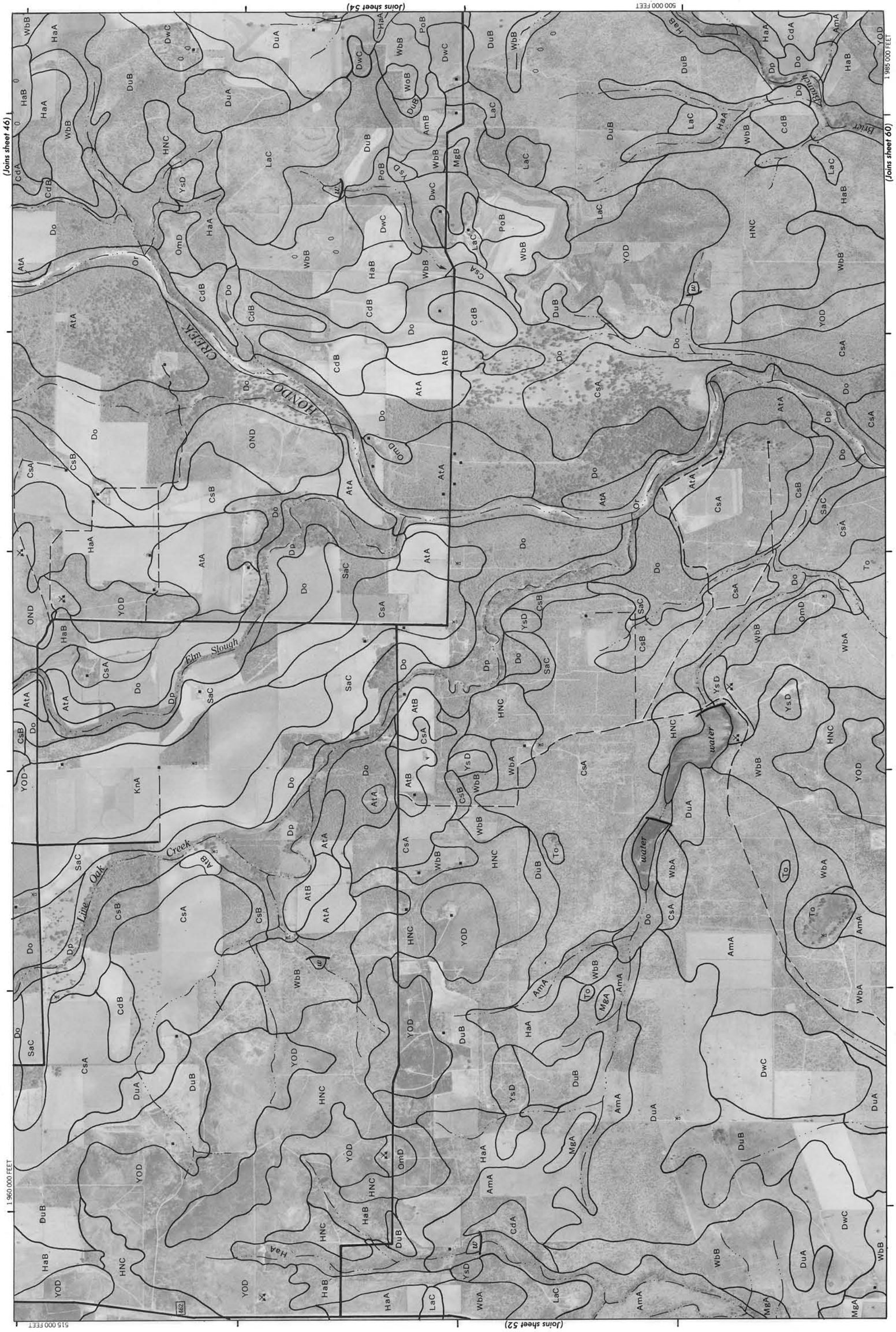


This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 52

SHEET NUMBER 53

MEDINA COUNTY, TEXAS — SHEET NO. 53



MEDINA COUNTY, TEXAS NO. 53

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 54

54

N

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

(Joins sheet 47)

2 015 000 FEET

515 000 FEET

(Joins sheet 53)

(Joins sheet 55)

500 000 FEET

(Joins sheet 61)

1 990 000 FEET

Black Creek

Briar Branch

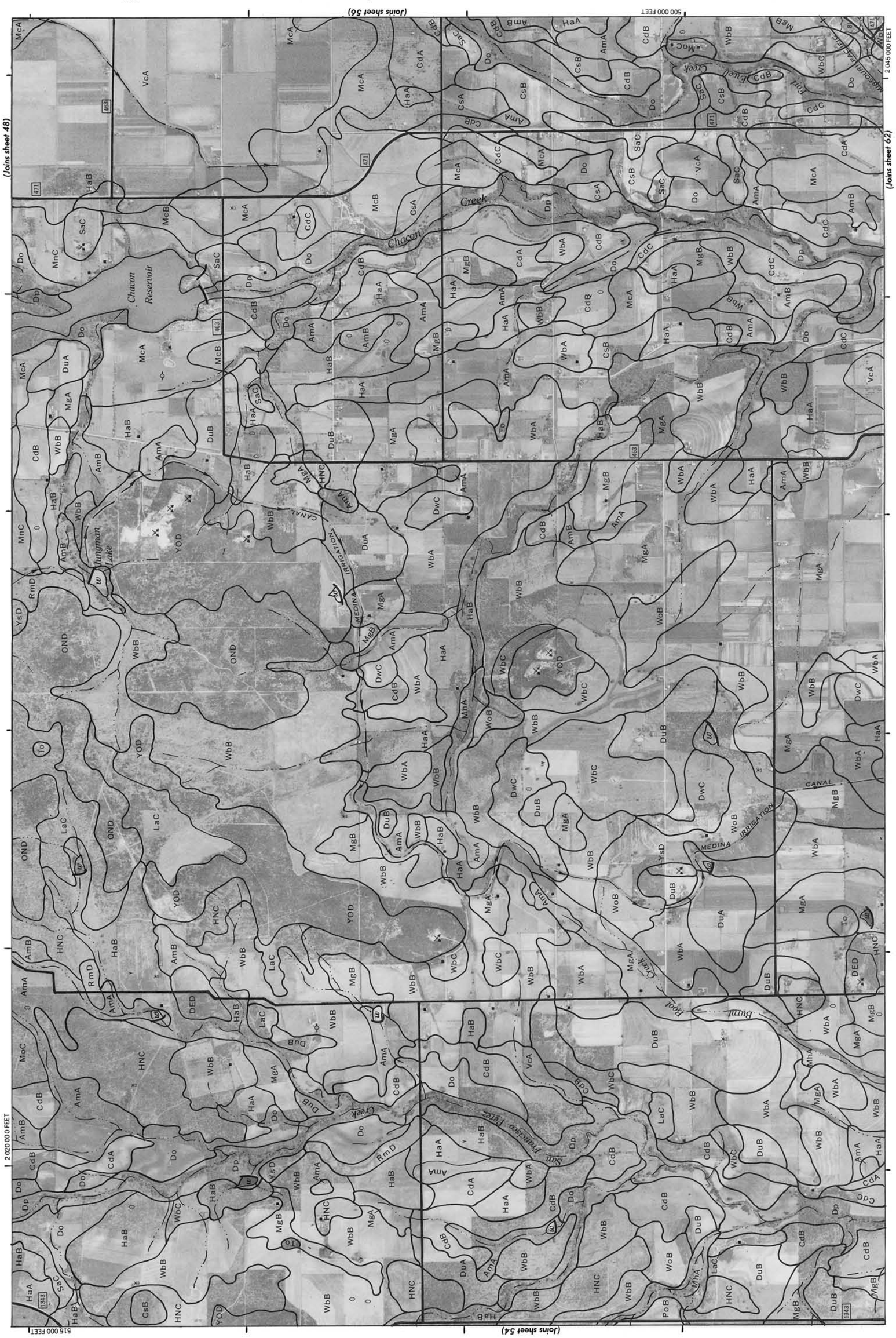
Biry

1343

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 54

MEDINA COUNTY, TEXAS — SHEET NUMBER 55



MEDINA COUNTY, TEXAS NO. 55

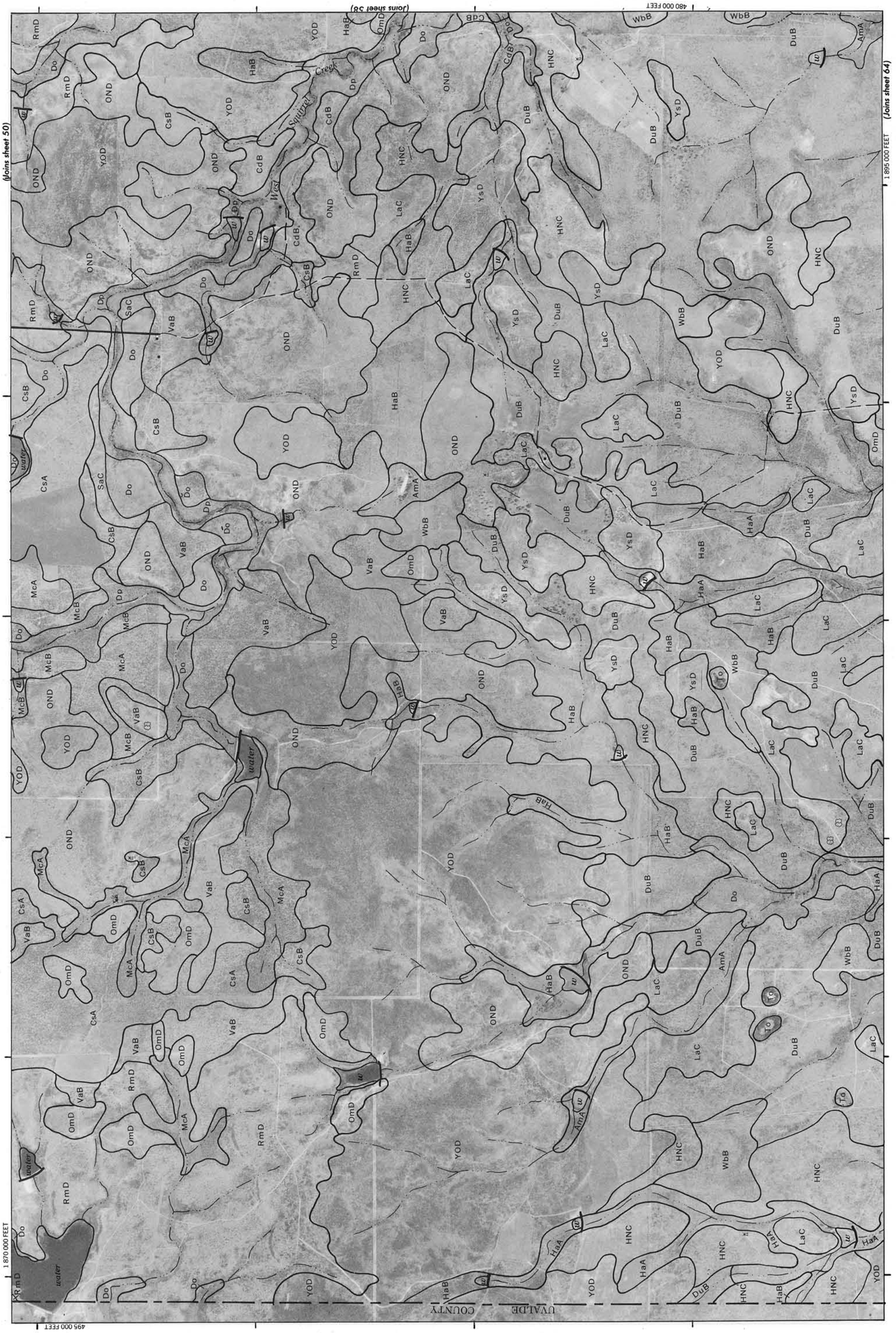
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 56

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 56

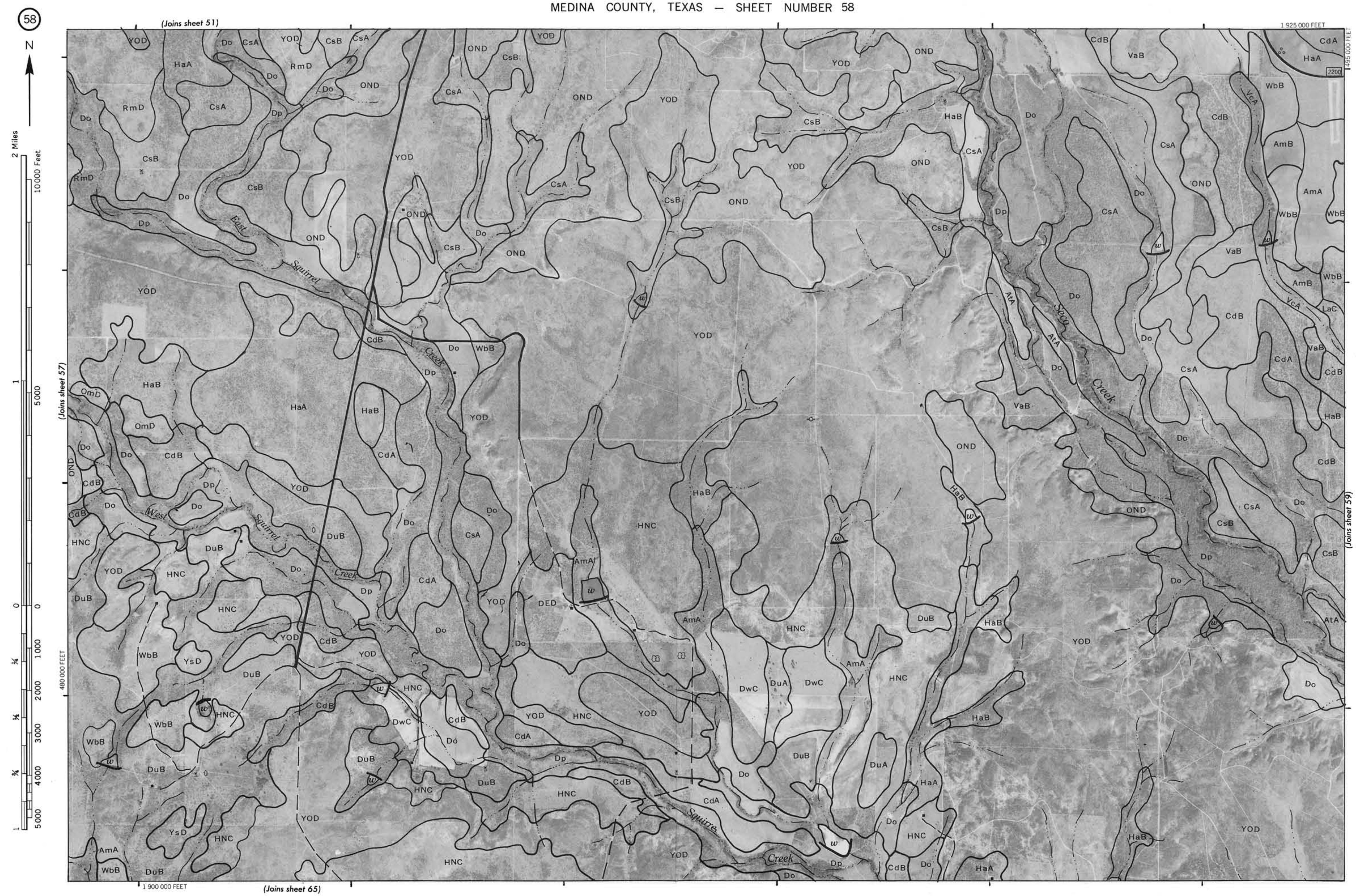
MEDINA COUNTY, TEXAS — SHEET NUMBER 57



MEDINA COUNTY, TEXAS NO. 57

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

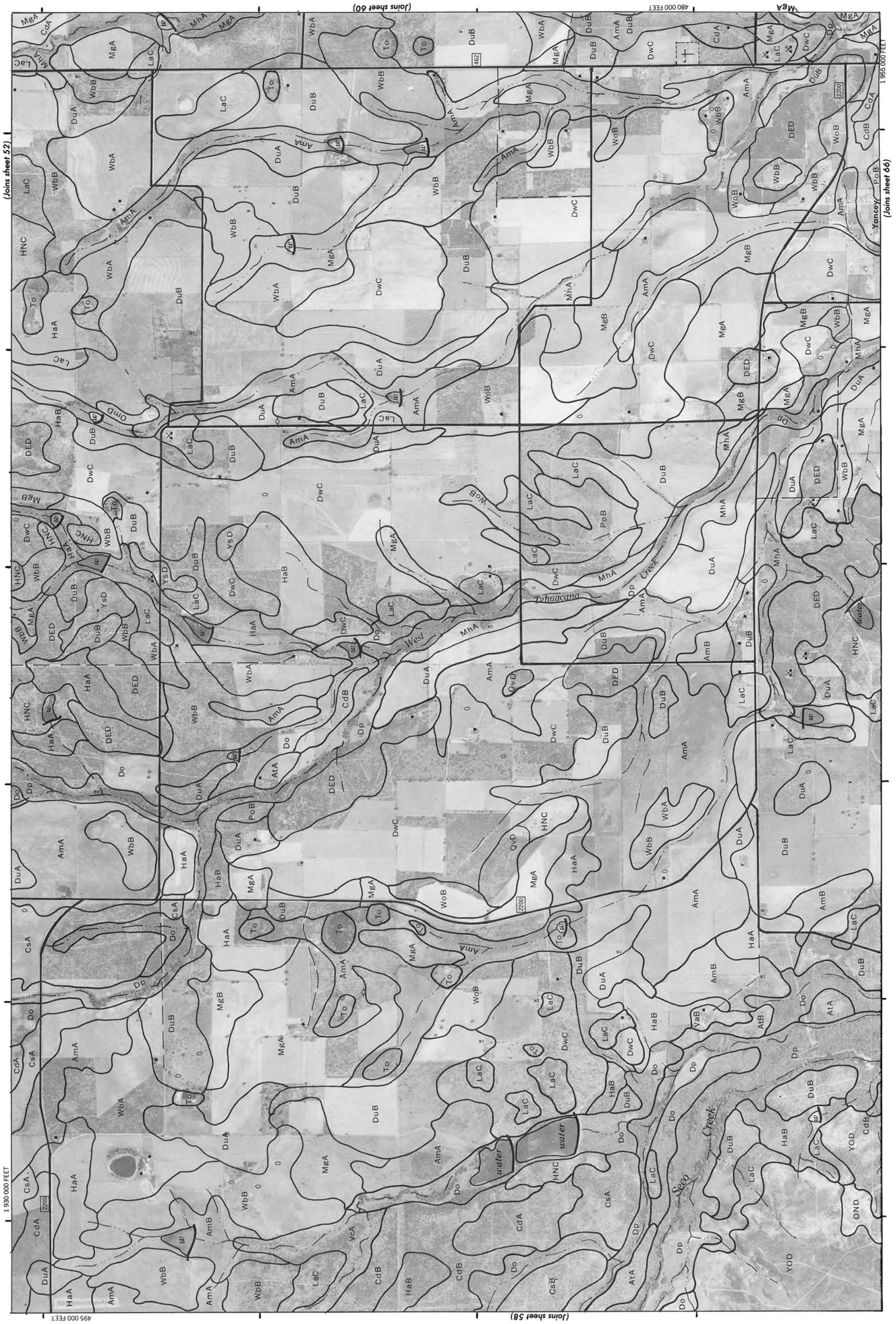
MEDINA COUNTY, TEXAS — SHEET NUMBER 58



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 58

MEDINA COUNTY, TEXAS — SHEET NUMBER 59



MEDINA COUNTY, TEXAS NO. 59

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 60

60

N

2 Miles

10000 Feet

1 5000

0 0

½ 1000

½ 2000

½ 3000

½ 4000

1 5000

(Joins sheet 53)

(Joins sheet 59)

(Joins sheet 61)

(Joins sheet 67)

1 985 000 FEET

495 000 FEET

480 000 FEET

1 960 000 FEET

Creek

Tehuacana Creek

East Tehuacana Creek

Brier Branch

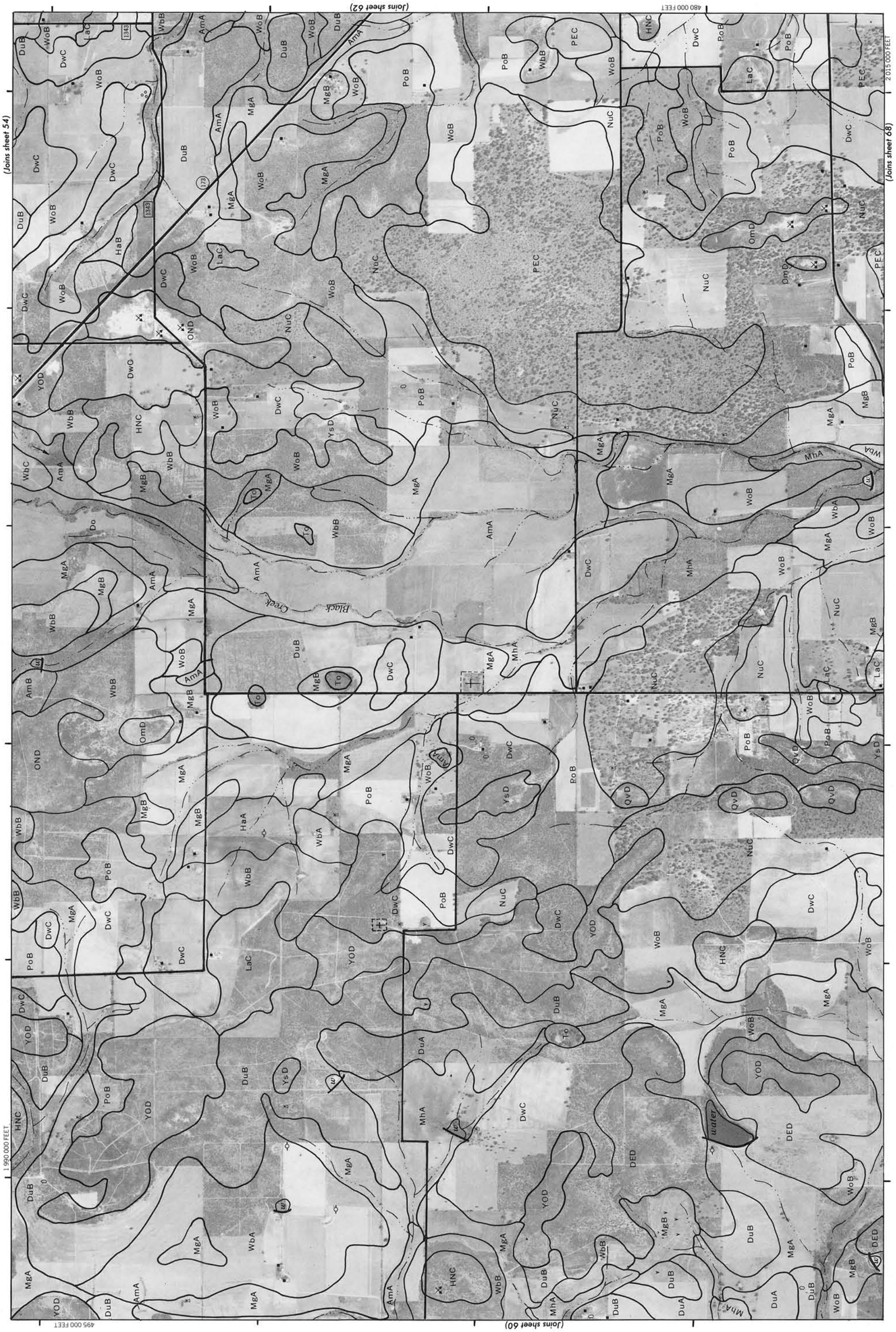
HONDO CREEK

Airfield

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 60

MEDINA COUNTY, TEXAS — SHEET NUMBER 61



MEDINA COUNTY, TEXAS NO. 61

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 62

62

N

2 Miles 1

10000 Feet 5000

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 55)

(Joins sheet 61)

(Joins sheet 69)

(Joins sheet 63)

2 045 000 FEET

2 020 000 FEET

495 000 FEET

480 000 FEET

NATALIA

DEVINE

Medina Lake State Fish Hatchery

MEDINA IRRIGATION CANAL

Burnt Boot Creek

Missouri Pacific

Fort Jewel Creek

Chacon Creek

San Expedito Perez Creek

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 62

MEDINA COUNTY, TEXAS — SHEET NUMBER 63

63

N

MEDINA COUNTY, TEXAS NO. 63

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(Joins sheet 56)

(Joins sheet 62)

(Joins sheet 70)

495 000 FEET

480 000 FEET

2 050 000 FEET

2 075 000 FEET

NATALIA

NATALIA CANAL

Leon Creek

Fort Leon Creek

Seguidero Branch Creek

MEDINA COUNTY

ATASCOSA COUNTY

WoB

MgB

NuC

PEC

PoB

MhA

2 Miles

10000 Feet

5000

1

5000 4000 3000 2000 1000 0 0

MEDINA COUNTY TEXAS — SHEET NUMBER 64

64

N

2 Miles 10000 Feet

1 5000 0 0 1000 2000 3000 4000 5000

(Joins sheet 57)

1 895 000 FEET

475 000 FEET

460 000 FEET

1 870 000 FEET

UVALDE COUNTY

FRIO COUNTY

Frio River

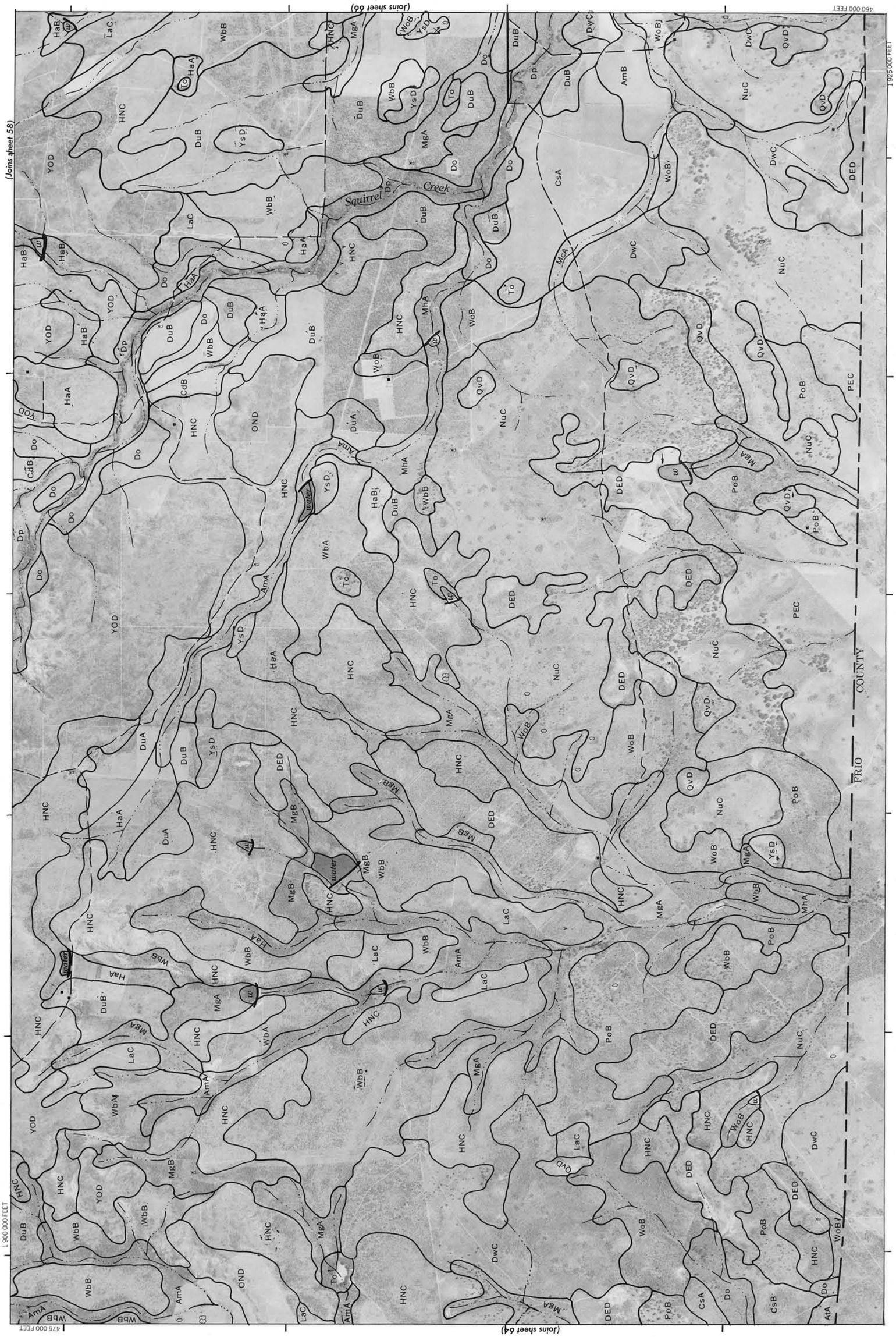
water

(Joins sheet 65)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 64

MEDINA COUNTY, TEXAS — SHEET NUMBER 65



MEDINA COUNTY, TEXAS NO. 65

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

66

N

2 Miles 10000 Feet

1 5000 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

(Joins sheet 59)

(Joins sheet 65)

(Joins sheet 67)

1 955 000 FEET

475 000 FEET

460 000 FEET

1 930 000 FEET

FRIO COUNTY

Yancey

West Tehuacana Creek

Seco Creek

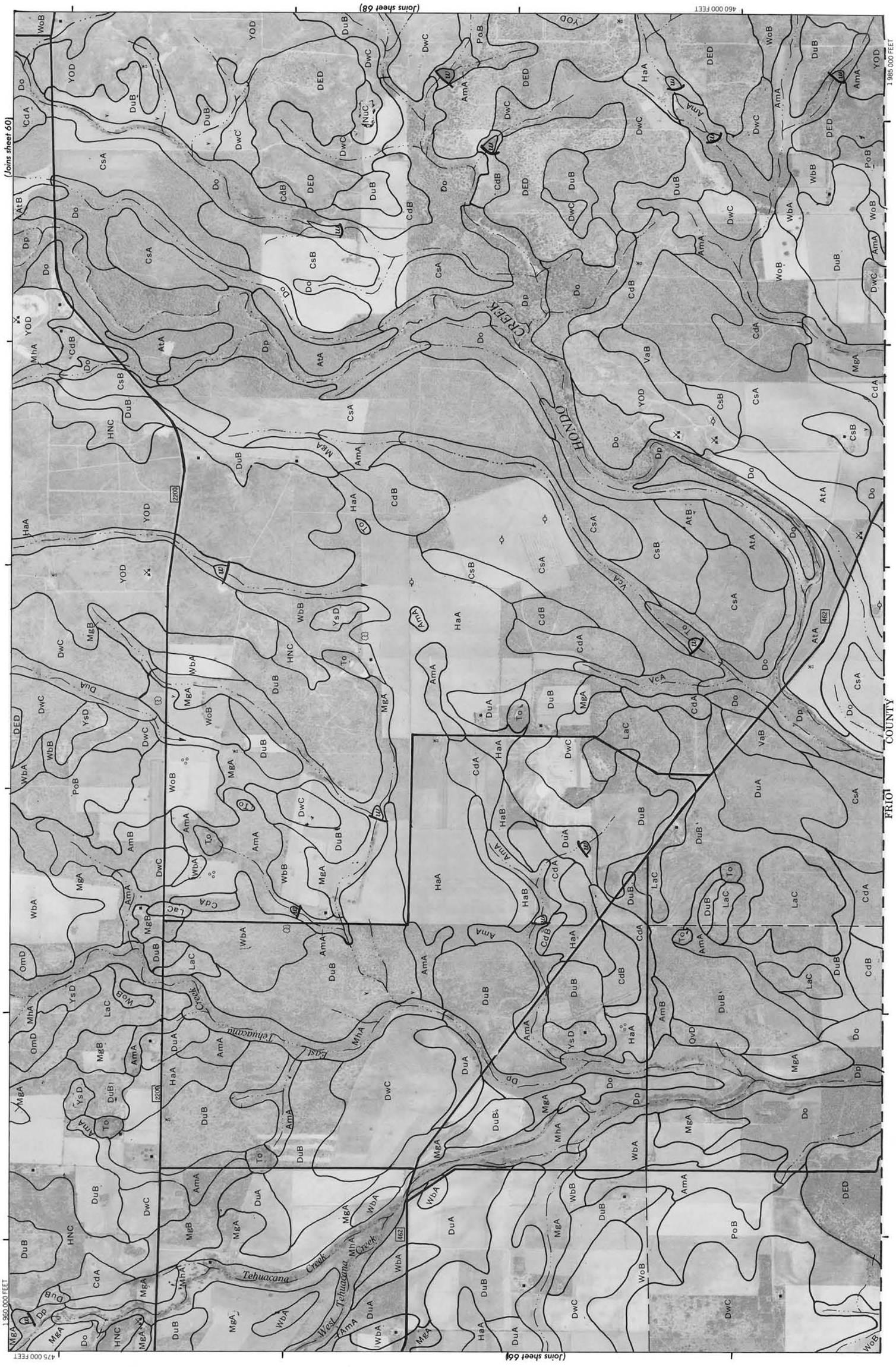
Squirrel Creek

Lake

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 66

MEDINA COUNTY, TEXAS — SHEET NUMBER 67



MEDINA COUNTY, TEXAS NO. 67

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

68

N

2 Miles 10000 Feet

1 5000 0 1000 2000 3000 4000 5000

(Joins sheet 61)

(Joins sheet 67)

(Joins sheet 69)

2 015 000 FEET

415 000 FEET

460 000 FEET

1 990 000 FEET

Black Creek

FRIO COUNTY

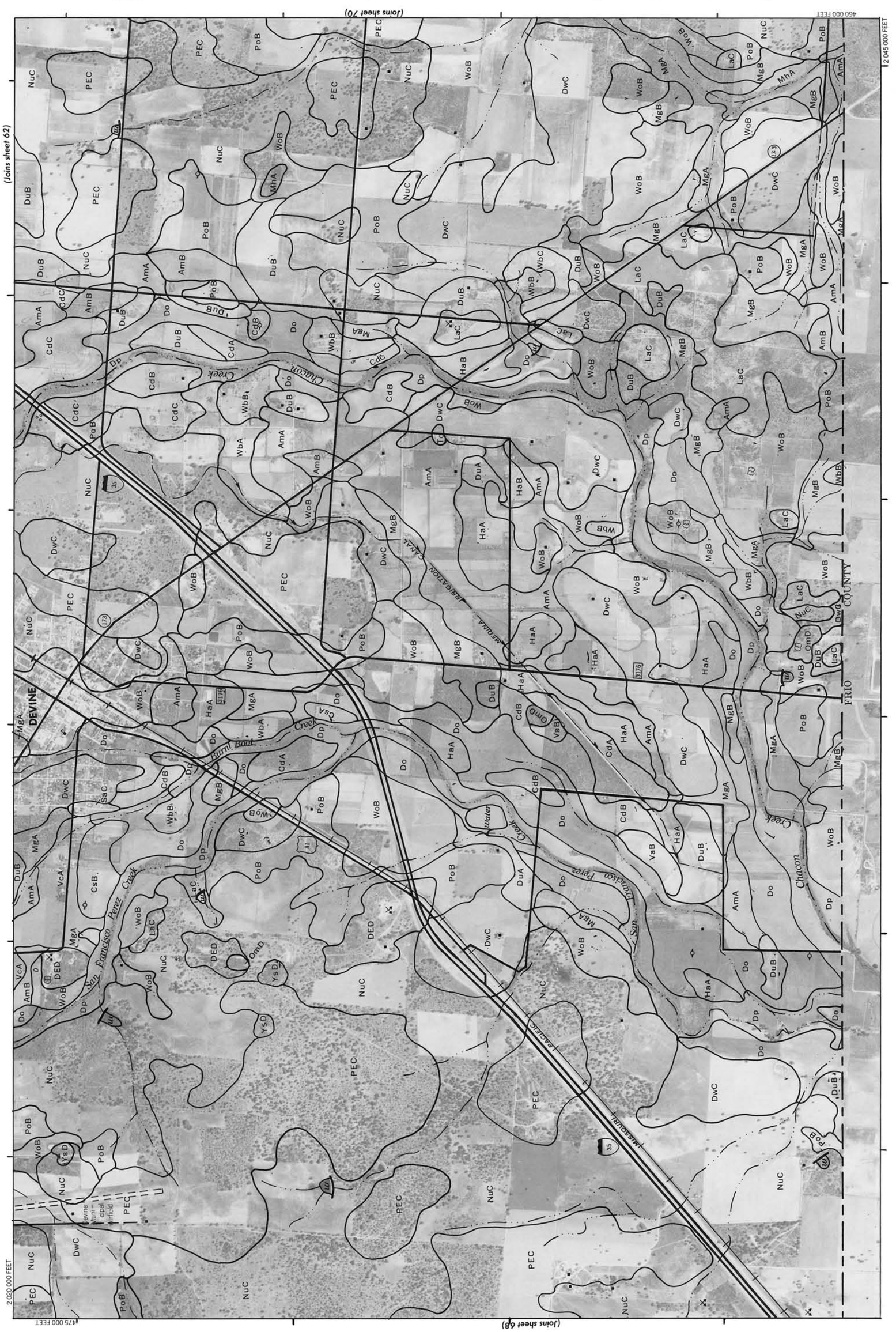
MISSOURI PACIFIC

38

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 68

MEDINA COUNTY, TEXAS — SHEET NUMBER 69



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS — SHEET NUMBER 70

1 ¾ ½ ¼ 0 1 2 Miles

5000 4000 3000 2000 1000 0 5000 10000 Feet

N

70

460 000 FEET

(Joins sheet 69)

(Joins sheet 63)

2 050 000 FEET

NuC PoB MgA WoB DwC PEC

FRIO COUNTY

ATASCOSA COUNTY

Bear Creek

Siesteadero Branch Creek

2075 000 FEET

475 000 FEET

(Joins sheet 4)

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

MEDINA COUNTY, TEXAS NO. 70